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PICOGRAM v. 78

and Abstracts

Chemistry for and from Agriculture

American Chemical Society

239th National Meeting and Exposition

March 21— 25, 2010

San Francisco, California, USA

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SPRING 2010 AGRO MEETING SCHEDULE

Program: page 57; Abstracts: page 78

The Moscone Center

SYMPOSIA & MEETINGS – West Building; **SCI-MIX** – Hall D

AGRO POSTER SESSIONS run 9:30 AM – 4 PM on Mon, Tues, Wed in Rm. 3011 with the **AGRO COFFEE HOURS**

SYMPOSIUM OR SESSION/SECTION	ORGANIZER(S)	Rm	Sun	Mon	Tue	Wed	Thu
Advances in Discovery of New Agrochemicals: ACS Team Innovation Award and Spencer Award	Stevenson, Hellmuth	3001	A				
Contemporary Food Safety Issues: Mitigating Risks from Production to Processing	Seiber, Molyneux	3003	D				
Invasive Species: Is Chemistry up to the Task?	Ellis, O'Toole, Racke	3005	D				
Understanding Greenhouse Gases from Agriculture	Gunasekara, Guo, McConnell, Pittiglio	3007	D	A			
Increasing the Utility of Terrestrial Field Dissipation Data	Barefoot	3001	P				
AGRO Business Meeting	Arthur	3011	E				
AGRO Division Posters – General, Urban Exposures, Bio-fuels/Bioproducts, Greenhouse Gases from Agriculture	Johnston, Racke	3011		***D***			
International Award for Research in Agrochemicals: Strategic Molecular Designs of Neonicotinoid Insecticides: Symposium to Honor Dr Shinzo Kagabu	Casida, Tomizawa	3001		D			
Pesticide Mitigation Strategies for Surface Water Protection	Bret, Goh, Potter, Poletika	3003		D	A		
Push for Greener Formulations: Evolving Regulatory Framework for Inerts and Co-Formulants	Cleveland, Yowell, Shah	3005		D			
New Investigator Award (Arthur, Racke – Presiding)	Felsot	3005		PL			
Adv. Biofuels & Bioproducts: LCA & Sustainability	Hapeman, Seiber	3007		P			
SCI-MIX Poster Session	Johnston, Racke	***Hall D***		E			
AGRO Division Posters – Student Awards, Surface Water Mitigation, Urban Water Quality	Johnston, Racke	3011			***D***		
Comparing Conventional and Biotechnology-Based Pest Management	Duke, Ridley, Carstens, Storer	3001			D	A	
Pesticides in Urban Settings/Aggregate Human Exposures	Stout, Krieger	3005			D		
Symposium and Celebration in Honor of Prof. John Casida	Ruzo, Johnston, Seiber	3007			D	D	
Sterling-Hendricks Award	Kaplan, Tunick, Duke	3016			MD		
Pesticides and Urban Water Quality: Monitoring, Modeling, and Mitigation	Gan, Hendley, Spurlock	3003			P	D	
AGRO Social Hour and Mixer	Arthur	2020			E		
AGRO Division Posters – Casida Celebration, Chiral Pesticides, Emerging CA Coastal Contaminants	Johnston, Racke	3011				***D***	
Efficient Application of Pesticides for Sustainable and Effective Crop Protection	Ozkan, Barefoot, Ramsay	3005				D	D
Emerging Contaminants in California's Coastal and Estuarine Ecosystems	Maruya, Sedlak, Rice, Armbrust, Klosterhaus	3001				P	D
AGRO Blues & Brews Program Planning Mixer	Barefoot	3009				E	
Third Agrochemical Symposium on Modern Chiral Pesticides: Enantioselectivity and its Consequences	Garrison, Gan, Liu	3003					D
Assessing Exposure of Pollinators to Systemic Pesticides	Fischer, Gould, Overmyer, Wisk	3007					D

***Legend**: A = AM; MD = mid-day; P = PM; PL = late PM; D = AM/PM; E = evening*

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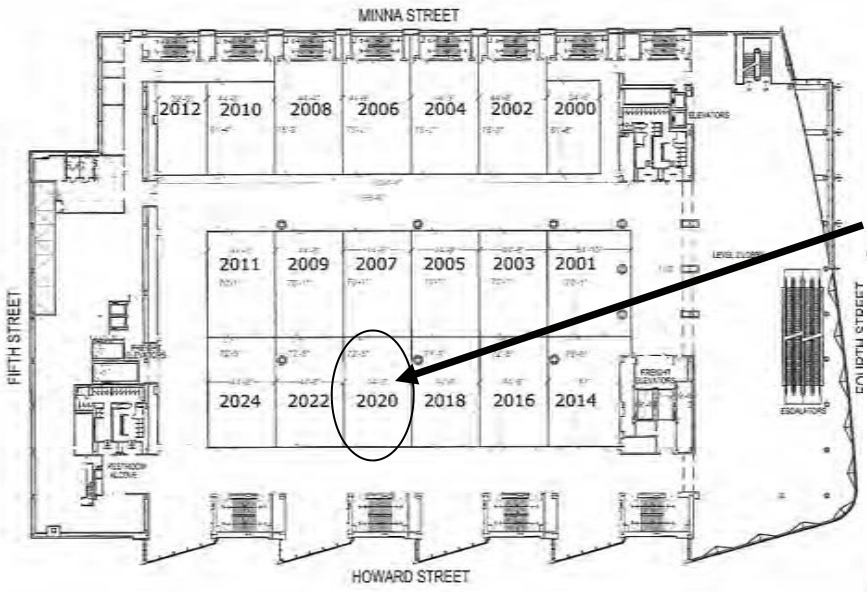
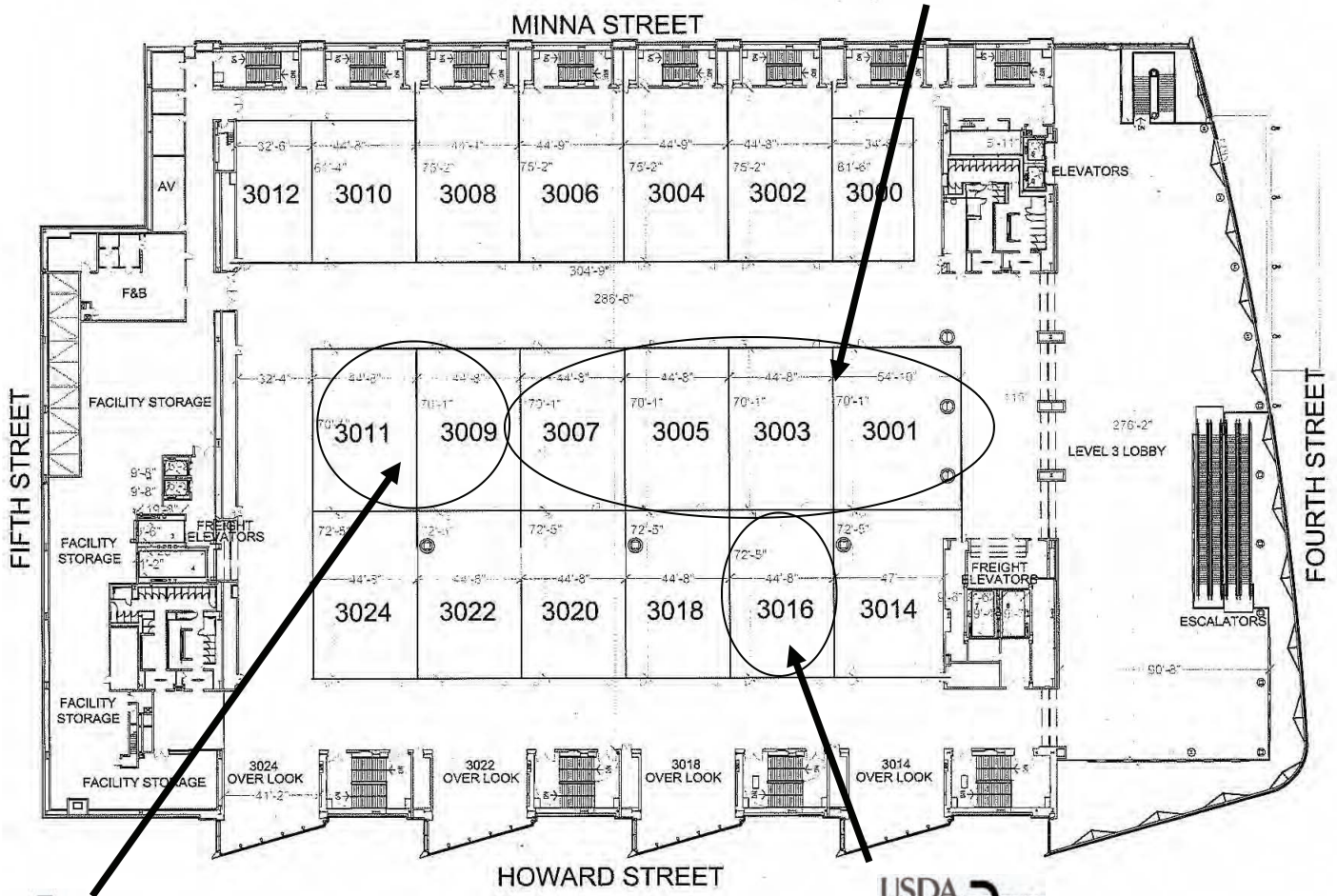


Social

Sections A-D (3001—7)
Grad Luncheon (3005)



Posters & Coffee (3011)
Blues & Brews (3009)

Sterling Hendricks Lecture

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Notes from the Communications Chair

Greetings Fellow AGROrians and welcome to our biggest meeting ever, again! Congratulations to Ken, Ellen, and all the organizers!

Three hundred sixty-four abstracts to edit and a new abstract submittal system to learn. What a time to expand! Many thanks go to all the organizers for their perseverance with the new system and for editing their symposia abstracts. And, special kudos to Ken for helping us through the nuances of PACS, coping with all the changes at crunch time, and capturing all the files we needed for the PICOGRAM.

AGRO tested a new PICOGRAM distribution approach at the Washington, DC. Hard copy was not mailed prior to the meeting. Instead, we made the electronic version was available a month prior to the meeting and distributed the PICOGRAM to participants at the meeting. Those who did not come to the meeting were sent a hard copy via snail mail afterwards.

Many of those attending thought this was a great approach and we agree. Thus, AGRO members will receive hard copy to the PICOGRAM at the meeting or after the meeting. And, beginning with this issue, non-US members will also receive hard copy of the PICOGRAM after the meeting.

Finally, I want to thank the Communications Committee who worked diligently to gather the pieces from the many sources for the PICOGRAM. I appreciate your dedication to the Division and your ability to pester people unrelentingly to capture the needed files.

Cheers,

CJ Hapeman

Cathleen J. Hapeman, Chair
Communications Committee/PICOGRAM Editor

From the Chair's Desk

Ellen L. Arthur

The Agrochemicals Division will be programming in San Francisco in March 2010, and as you can see from the Notes from our 2010 Program Chair Ken Racke, AGRO has an excellent program lined up.

The Division's move toward programming at one national ACS meeting per year has been very successful. With over 300 contributed papers for the San Francisco meeting, we have broken yet another record.

At the business meeting at the 2009 meeting in Washington, DC, the voting members decided to continue on with this programming strategy of one national meeting per year; the majority also voted to program at the Fall 2011 ACS meeting in Denver. The Division understands that it is critical to have a long-range plan for national meeting locations, and during the San Francisco business meeting, we will continue the discussion on meeting venues with the intent to have a plan for the next five years.

For those national meetings for which AGRO will not be planning a program, it is our goal to co-sponsor symposia with other relevant Divisions within ACS, and I encourage our membership to seek out such opportunities.

With one significant national meeting presence per year, this has allowed members to take advantage of opportunities to participate in collaborative efforts with other organizations such as the Society of Toxicology and Environmental Chemistry (SETAC), Pacifichem 2010, the Pan Pacific Conference on Pesticide Science, IUPAC International Congress on Pesticide Chemistry, and the International Workshop on Crop Protection Chemistry in Brazil.

Building relationships through such collaborations is very important to our Division, and will enhance our impact on the scientific community.

I want to thank you for this opportunity to Chair this Division, and I applaud our motivated and engaged membership for volunteering many hours with their hard-work and dedication to the continued success of the AGRO Division.

-Ellen Arthur

Watch for new announcements at our website

www.agrodiv.org

- AGRO activities and events details
- PICOGRAMs and Femtograms
- Links to interesting meetings
- Call for Papers
- How to join AGRO
- Award Nomination Forms
- Sponsorship information
- Officers and Executive Committee pages

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Hospitality Committee Report

Coffee Lounge in Washington, DC

Fifteen sponsors graciously donated a total of $2500 to support our coffee lounge held during the technical sessions in Washington, DC. We thank them for their generosity. Our coffee lounge offers a brief respite from our technical sessions by providing an alternative forum for further discussion of ideas, opportunities for networking, and viewing of literature displayed by our sponsors in the hospitality desk area. Contributors to the coffee lounge in Washington DC are listed below. If you wish to become a sponsor, please contact any of our committee members.

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AGRO Social at Washington, DC

The AGRO Division Awards & Social was held at the Renaissance Washington. Dr. R. Donald Wauchope was recognized as the recipient of the ACS International Award for Research in Agrochemicals. The Sterling B. Hendricks Memorial Lectureship Award recipient was Dr. Charles Arntzen. Dr. Jennifer Anderson was honored with the AGRO New Investigator Award. We also introduced the winners of the Young Scientists Pre- and Post-Doctoral Research Award Symposium to the revelers in attendance. Our inevitable prize drawing could not be stopped and drew smiles from surprised winners.

HOSPITALITY COMMITTEE MEMBERS - James Brady, Julie Eble, Joseph Massey & Patricia Rice
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	Dr. Philip C. Kearney
	Dr. Julius J. Menn
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	Dr. James P. Minyard, Jr.
	Dr. Joe C. Street
1975	Dr. Hank F. Enos
	Dr. Maurice B. Green
	Dr. Charles H. Van Middelem
1976	Dr. Marguerite L. Leng
	Dr. Jack R. Plimmer
	Dr. Gerald G. Still
1977	Dr. Gustave K. (Bob) Kohn
1978	Dr. S. Kris Bandal
	Dr. Paul Hedin
1979	Dr. Rodney D. Moss
1980	Dr. G. Wayne Ivie
	Dr. John B. Siddall (Posthumous)
1981	Dr. Robert M. Hollingsworth
	Dr. Gino J. Marco
1983	Dr. John Harvey, Jr.
1985	Mr. Henry Dishburger
	Dr. Richard C. Honeycutt
1986	Dr. Gunter (Jack) Zweig
1987	Dr. Willa Garner
1988	Dr. Jan Chambers
	Dr. James Seiber
1990	Dr. Joseph Fenyes
1991	Dr. Nancy N. Ragsdale
1992	Dr. Don Baker
	Dr. Joel Coats
	Dr. Guy Paulson
1993	Dr. Larry Ballantine
1994	Dr. James Heitz
	Dr. Ralph Mumma
	Dr. Willis Wheeler
1996	Dr. John Bourke
1998	Dr. Hank Cutler
	Mr. Paul Giesler
2000	Dr. Barry Cross
2001	Dr. Robert Hoagland
2003	Dr. Judd O. Nelson
2005	Dr. Rodney Bennett
2006	Dr. Terry D. Spittler
2007	Dr. Ann T. Lemley
	Dr. R. Don Wauchope
	Dr. John M. Clark
2008	Dr. Allan S. Felsot

AGRO Awards Committee Report

Dr. Shinzo Kagabu, Gifu University, Gifu, Japan will receive the International Award for Research in Agrochemicals at the Spring, 2010 ACS meeting in San Francisco in recognition of his seminal discoveries leading to development and extensive use of the neonicotinoid insecticides. DuPont Crop Protection and BASF will cosponsor the award which will be presented on Monday, March 22, at 8:00 AM. A one-day symposium honoring Dr. Kagabu and research in this area of pesticide science has been organized by Professors John Casida and Ernest Hodgson. Please join Dr. Kagabu and colleagues in celebrating this award.

Congratulations also to **Dr. Chris Somerville**, Director of the Energy Biosciences Institute, Lawrence Berkeley National Laboratory, UC Berkeley, who is the recipient of the 2010 Sterling B. Hendricks Memorial Lectureship Award, sponsored by the USDA-Agricultural Research Service and cosponsored by AGRO Division the Agricultural and Food Chemistry Division. The Award will be presented by Dr. Edward Knipling, ARS Administrator, immediately preceding Dr. Somerville's award address "Development of cellulosic biofuels," in ceremonies starting at 11:30 am, Tuesday, March 23.

Dr. Kyong Sup Yoon will receive the AGRO New Investigator Award for his research concerning elucidation of the specific binding site of pyrethroid insecticides. He will present his paper, "Action of the pyrethroid insecticide decyanoazidofenvalerate on rat $Na_v1.8$ sodium channel expressed in *Xenopus* oocytes," in the New Investigators Symposium on Monday afternoon, March 22. This award is sponsored by Dow AgroSciences. In addition, seventeen students received the AGRO Education Travel Awards which are sponsored by Bayer CropScience. Their posters can be viewed at the Tuesday, March 23, poster session.

Please consider nominating a deserving individual for future International Awards for Research in Agrochemicals (page 23) and the Sterling B. Hendricks Memorial Lectureship (page 25). The Awards Committee is also accepting nominations for the Division Fellow Award, which recognizes members whose dedicated and enthusiastic service has kept the Division moving forward (see below). Application procedures for the New Investigator Award and the AGRO education Travel Awards can be found on pages 27 and 33, respectively.

Congratulations to Drs. Kagabu, Somerville, and Yoon and to our student award winners.

On behalf of the AGRO Awards committee,

James N. Seiber, Chair
Awards Committee

CALL FOR NOMINATIONS
AGRO Division Fellow Award

The AGRO Division has established the ***Fellow Award*** to recognize its members whose dedicated and enthusiastic service has kept the Division moving forward.

Criteria shall be –

Continued and substantial contributions of time, talents, and service to the Division of Agrochemicals, ACS, and agrochemical science over a period of at least six years.

Nominations include a letter, noting the contributions to the Division, and current *curriculum vitae*. Deadline for submitting nominations is May 31 of each year. Contact the Awards Committee for further information.

Dr. James Seiber, Chair
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One Shields Avenue
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Analytical Chemistry:	Method development and validation, ILV, clinical sample analysis, analysis of agrochemicals and metabolites in soil, water, air, crops and animal tissues.
Field Studies:	Terrestrial and aquatic dissipation, rotational crops, nature and magnitude of residues in crops, lysimetry and small plot dissipation studies utilizing radiolabels. Volatility and flux determination.
Exposure:	Cow and hen feeding studies, dislodgeable foliar and turf residues, mixer/loader and applicator dosimetry. Environmental monitoring (air and water). Tobacco pyrolysis.
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The AGRO Division Awards & Social

Meet with Friends Old and New
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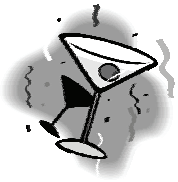
ACS International Award for
Research in Agrochemicals
Shinzo Kagabu

AGRO New Investigator Award
Kyong Sup Yoon

AGRO Education Awards

ACS Award for Team Innovation
Daniel Cordova
John Freudenberger
Thomas Selby
Thomas Stevenson

Kansas City Section Spencer Award
George Lahm



Fun, Food, Good Company, Door Prizes, and a Cash Bar
6:00 – 8:00 pm Tuesday, March 23
The Moscone Center – Room 2020 West Building

ALL AGRO DIVISION MEMBERS, SPEAKERS, AND THEIR GUESTS/SPOUSES/SOs,
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ACS INTERNATIONAL AWARD FOR RESEARCH IN AGROCHEMICALS

Presented by the AGRO Division of ACS
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PROFESSOR SHINZO KAGABU is the principal discoverer and father of the neonicotinoid insecticides, following in the path of Paul Müller for the chlorinated hydrocarbons, Gerhard Schrader for the organophosphates, Robert Metcalf for the methylcarbamates, and Michael Elliott for the pyrethroids. These are the four major classes of synthetic organic insecticides. The neonicotinoids are the newest class and are gradually replacing the organophosphates and methylcarbamates. It is now appropriate and timely for Shinzo Kagabu to receive the Agrochemical Award for his discoveries, developed by Bayer, and laying the background for a family of compounds from several companies.

Dr. Kagabu studied tropolone chemistry for his Master thesis at Tohoku University, Japan and investigated non-benzenoid aromatic compounds for his Ph.D. degree at Freiburg University, Germany in 1976. Shinzo first prepared imidacloprid in 1985 when he was a researcher in the pesticide development project in Nihon Tokushu Noyaku Seizo (presently Bayer CropScience, Japan). Astonishingly in his seven-year period at the Bayer laboratory, he also discovered another neonicotinoid thiacloprid and anti-rice blast fungicide carpropamid. Neonicotinoid insecticides pioneered by imidacloprid, with excellent control effectiveness and safety to people and the environment, are extensively used throughout the world for crop protection particularly against sucking insect pests, accounting for more than one-fifth of the total world insecticide market. Imidacloprid is also the preeminent insecticide for flea control on companion animals.

After Shinzo moved to an academic research position (Gifu University, Japan), he continued his neonicotinoid research in the chemical approaches, along with pursuing fundamental research on cyclopropane chemistry. His achievements related to the neonicotinoid field involve mechanisms of photostabilization; crystallographic analysis revealing the basis for their unique physicochemical properties; structure-activity relationships. Dr. Kagabu was the principal contributor to development of the photoaffinity probe 5-azidoimidacloprid which facilitated the ultimate definition of neonicotinoid molecular recognition at the receptor. Moreover, his efforts in exploring novel chemical structures led to discovery of alkylene-tethered bis-neonicotinoid insecticides.

His studies on pesticide chemistry and other fields have resulted in 150 papers and patents. His seminal contributions have been honored in Japan (two Pesticide Science Society Japan Awards and Japanese Minister of Agriculture, Forestry, and Fishery Award) and Germany (Otto Bayer Medal). Therefore, Dr. Kagabu is now recognized more broadly with the ACS International Award for Research in Agrochemicals.

A four part symposium entitled

International Award for Research in Agrochemicals: Strategic Molecular Designs of Neonicotinoid Insecticides. Symposium in Honor of Dr. Shinzo Kagabu

will be held in Professor Kagabu's honor
on Monday, March 22, at 8:00 AM
in
The Moscone Center – Room 3001 West Building

The AGRO Division is grateful for the sustained support of the International Award sponsors.

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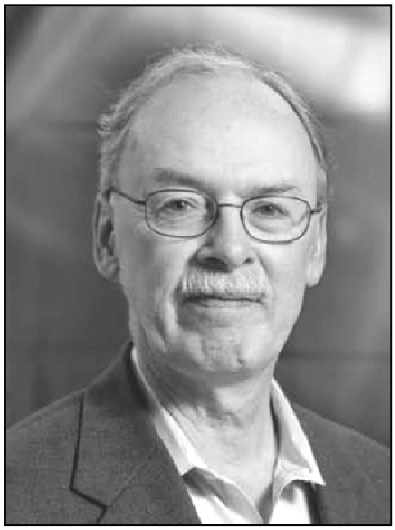

DR. CHRIS SOMERVILLE is a biochemist who has been recognized for his work on the biochemistry, cell biology, genomics and genetics of various aspects of plant and microbial growth and development. He was one of the early advocates for the development of Arabidopsis as a model system to dissect plant growth and development and was the first chairperson of the Arabidopsis Genome Initiative, an international collaboration that completed the sequence of the first plant genome.

The majority of Dr. Somerville's research contributions have concerned the synthesis and modification of membrane and storage lipids, and the synthesis of polysaccharides. Somerville and his collaborators characterized many of the genes and proteins involved in fatty acid desaturation and hydroxylation, and proposed the mechanism for desaturation and hydroxylation based on spectroscopy and protein engineering. His recent work on polysaccharides has been largely focused on the use of live-cell imaging of single cellulose synthase complexes and cytoskeletal components to dissect the basic mechanisms of cellulose synthesis.

Dr. Somerville is the Director of the Energy Biosciences Institute, a research institute at UC Berkeley, Lawrence Berkeley National Lab and the University of Illinois Urbana-Champaign initiated with a $500M award from the energy company BP (www.energybiosciencesinstitute.org). He is the Philomathia Professor of Alternative Energy at UC Berkeley. He was a professor at Stanford University and director of the Carnegie Institution for Science from 1994-2007 and a professor at the Michigan State University DOE Plant Research laboratory from 1982-1993.

He has published more than 200 scientific papers and patents in plant and microbial genetics, genomics, biochemistry, and biotechnology. He is a member of the US National Academy of Sciences, The Royal Society of London and the Royal Society of Canada and has received numerous scientific awards including the Gibbs and Schull awards from the American Society of Plant Biologists, the Mendel Medal from the Genetics Society, the Hopkins medal from the Biochemical Society, the Khumo Award from the Plant Molecular Biology Society and most recently the Balzan Award which he shared with Elliot Meyerowitz (Caltech). He cofounded three companies, Mendel Biotechnology, LS9 Inc, and Poetic Genetics.

Dr. Somerville will deliver his lecture immediately following presentation of the Sterling Hendricks Award on

March 23 at 11:30 am in the
The Moscone Center - Room 3016 West Building

A reception will follow at 12:45 pm

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2010 AGRO New Investigator Award

Presented by the AGRO Division of ACS
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DR. KYONG SUP YOON is an insecticide toxicologist and a medical entomologist. He received his M.S. in 2001 and his Ph.D. in 2006, both from University of Massachusetts-Amherst. While pursing his master's research, he successfully determined the inducible oxidative metabolism of abamectin as a principal resistance mechanism in Colorado Potato Beetle (CPB), *Leptinotarsa decemlineata Say*. Dr. Yoon developed the first *in vitro* rearing system for large-scale maintenance of human head lice *Pediculus capitis* under laboratory conditions while conducting Ph.D. research. This system has become an industry standard to test formulated pediculicides. His graduate work was recognized by AGRO in the student award programs at the 2001 and 2006 National ACS meetings.

After graduation, Dr. Yoon expanded his efforts in bed bug resistance to deltamethrin and determined that a population collected from New York City was 264-fold more resistant compared to an insecticide-susceptible population. In this study, he and his colleagues identified two point mutations in voltage-sensitive sodium channel α-subunit gene from the deltamethrin-resistant bed bugs. This work was published in *Journal of Medical Entomology* and authors received Editors Choice Award for the Best Article of 2008.

Dr. Yoon's current research focuses on elucidation of the specific binding site of a pyrethroid insecticide on the mammalian G-protein beta subunit and the rat voltage-sensitive sodium channel α-subunit (SNS or $Na_v1.8$). He is an adjunct assistant professor in the Department of Natural Resources and Conservation, University of Massachusetts-Amherst and laboratory manager under Dr. J Marshall Clark's supervision. He has trained students who are new to the laboratory or who need to acquire specific research techniques for their research projects. He is also a lecturer/instructor for courses offered in Environmental Science Program.

Dr. Yoon will present his paper at the
New AGRO New Investigator Award Symposium
on Monday afternoon, March 22 in the
The Moscone Center – Room 3005 West Building

The AGRO Division is grateful for the sustained support of the New Investigator Award sponsor.

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ACS Team Innovation Award

Sponsored by the ACS Corporation Associates

Purpose: *To highlight the value and importance of technical teams and teamwork to the chemical and allied industries by recognizing a multidisciplinary team for successfully moving an innovative idea to a product now in commercial use.*

DANIEL CORDOVA obtained a B.A. in biology from the University of Delaware in 1985 and an M.S. in biomedical engineering from Drexel University in 1996. From 1985 to 1987, Cordova characterized chemical warfare agent inhibitors at the U.S. Army Medical Research Institute of Chemical Defense. He joined DuPont Crop Protection in 1987 as an associate scientist and is now a section research biologist, elucidating mode of action of insecticides and nematocides, as well as developing target-site assays. A member of ACS, the Entomological Society of America, and the Biophysical Society, Cordova received the DuPont Sustainable Growth Excellence Award and R&D 100 Award in 2008. He enjoys camping with his family and coaching his children's school's Science Olympiad teams.

JOHN H. FREUDENBERGER received a B.S. in chemistry from the University of Cincinnati in 1982, performing two years of undergraduate research under Milton Orchin. He went on to obtain a Ph.D. in inorganic chemistry from the Massachusetts Institute of Technology in 1986, working under the direction of Richard Schrock. He then spent two years as a Miller Postdoctoral Fellow at the University of California at Berkeley, working in the laboratories of Robert Bergman and Steven Pedersen. He joined DuPont in 1988 as a research chemist in Specialty Chemicals at Jackson Laboratory. He transferred to Crop Protection in 1995, where he is currently a research fellow. A member of ACS since 1982, Freudenberger has also been honored with the DuPont Bolton-Carothers Innovative Science Award, the DuPont Sustainable Growth Excellence Award, and the R&D 100 Award, all in 2008.

THOMAS P. SELBY received a B.S. in chemistry from Indiana University of Pennsylvania in 1975 and a Ph.D. in organic chemistry from Indiana University, Bloomington, in 1979 under E. Campaigne. He joined DuPont Crop Protection in 1979 as a research chemist, rising to his current position of senior research fellow. A member of ACS since 1978, Selby has just been honored with the DuPont 2010 Pedersen Medal. He has also received the DuPont Bolton-Carothers Innovative Science Award, the DuPont Sustainable Growth Excellence Award, and the R&D 100 Award, all in 2008, and the DuPont Crop Protection Scientific Leadership Award in 1992.

THOMAS M. STEVENSON obtained a B.S. in chemistry from Saint Louis University in 1979 and a Ph.D. in organic chemistry from the University of Illinois in 1983 under Nelson J. Leonard. After postdoctoral research at the University of Geneva from 1983 to 1985, Stevenson joined DuPont Crop Protection as a research chemist and has risen in ranks to his current position as senior research fellow. A member of ACS, Stevenson has just been honored with the DuPont 2010 Pedersen Medal. He has also received the DuPont Bolton-Carothers Innovative Science Award, the DuPont Sustainable Growth Excellence Award, and the R&D 100 Award, all in 2008. The DuPont Crop Protection Scientific Leadership Award which he received in 1994 allowed him to spend a sabbatical in the labs of Paul Knochel at Phillips-Universität Marburg in Germany during 1996.

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Tuesday March 23 at 4 PM in the Moscone Center – Room 3007 West Building

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DR. GEORGE P. LAHM was born in New York City and grew up on Long Island. He obtained his B.S. in chemistry from the State University of New York, Oswego in 1976 and a Ph.D. in organic chemistry from Indiana University under Richard M. Jacobson. In 1980, he joined the Insecticide Discovery group DuPont Crop Protection and, in 2007, was appointed Dupont Fellow, DuPont's highest technical rank.

Dr. Lahm's pioneering research in the area of pyrazoline-based insecticides set the stage for the discovery of the novel sodium channel blocker, indoxacarb. Early work led to the identification of a variety of new chemical classes of sodium channel blockers and established the core structural features at this site. While highly active, the original leads were acutely toxic and prone to bioaccumulation. Lahm led the team that optimized around these issues and delivered the first commercial product to work via this new mode of action. Indoxacarb, marketed as Steward® and Avaunt® demonstrates outstanding field efficacy, environmental compatibility, and safety to non-target organisms.

In 1999, Lahm discovered the anthranilic diamides, a new class of insecticides, and led DuPont research teams in the discovery of both Rynaxypyr® and Cyazypyr™. He points to this period as the most exciting in his career as they drove a rapid advance from lead discovery to two of the most active insecticides ever developed. Rynaxypyr® represents a new landmark for insect control. It sets the standards for efficacy, use rate and plant protection. It exhibits equally impressive margins of safety to the environment, farmers, and consumers due to its unique mode of action, ryanodine receptor activation. Cyazypyr™ possesses a complementary spectrum of activity. It sets the same standard in efficacy and safety and will be a market-changing product when introduced in 2012.

Dr. Lahm was the recipient of the 2003 ACS Team Innovation Award for the discovery of indoxacarb. He has also been the recipient of several DuPont honors including the 2004 Pedersen Medal for scientific achievement, the 2003 and 2008 Bolton-Carothers corporate team awards for the respective discoveries of indoxacarb and Rynaxypyr®, and a 2004 Crop Protection R&D award for the discovery of Cyazypyr™. Other awards include the DuPont Sustainable Growth Excellence Award (2008), and the DuPont Crop Protection Scientific Leadership (1994). In 2010, Dr. Lahm was awarded the Lavoisier medal, DuPont's highest technical award for lifetime contributions.

George and his wife Louise have two children, Sarah and Michael. He is an avid runner and triathlete and has competed in the Boston and New York marathons. He has published extensively in peer reviewed journals and holds 49 US and World patents.

The Spencer Award was presented in October 2009 in Kansas City

A Special Symposium will be held on Sunday morning, March 21 in

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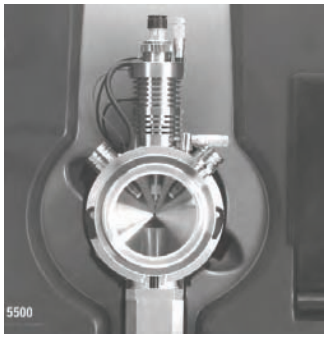

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AGRO SALUTES
DR. JOHN EDWARD CASIDA

http://nst.berkeley.edu/

DR. JOHN E. CASIDA holds the William Muriece Hoskins Chair in Chemical and Molecular Entomology at the University of California, Berkeley. He received his Ph.D. from University of Wisconsin-Madison in 1954. Dr. Casida is a renowned research leader in the areas of toxicology and mode of action of most major insecticides, herbicides, fungicides, including pyrethroids, organophosphates and neonicotinoids. Dr. Casida's research accomplishments have resulted in a remarkable 31 patents and nearly 800 publications.

Presently, Dr. Casida's research focuses on several areas. The first concerns isolation, identification, and synthesis of neuroactive botanical insecticides and elucidation of their mode of action. Another research area is characterizing the bioactivation mechanisms and target diversity of phosphorus-containing pesticides with emphasis on non-cholinergic effects. This includes not only insecticides but also fumigants and plant growth regulators. A third research thrust is identifying reactive intermediates in toxicant action to provide a more fundamental understanding of adverse toxicological effects from short-lived species implied in bioactivation reactions or environmental alteration processes.

Dr. Casida is a member of the U.S. National Academy of Sciences (1991), the European Academy of Sciences (2004) and the UK Royal Society (1998). In 1993, he was awarded the Wolf Prize in Agriculture "for his pioneering studies on the mode of action of insecticides, design of safer pesticides, and contributions to the understanding of nerve and muscle function in insects". Additional honors include the Founders Award from the Society of Environmental Toxicology and Chemistry (1994) and the Koro-Sho Prize from the Pesticide Science Society of Japan (1995).

On Tuesday and Wednesday, March 23 & 24

AGRO is sponsoring a

Symposium in Honor of John Casida

in

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Speakers include

Dr. Casida

Former students, post-docs, and colleagues

All national ACS meeting participants are welcome.

Program begins on page 66.

PAST AWARDEES OF THE BURDICK AND JACKSON INTERNATIONAL AWARD

1969 Dr. John E. Casida, University of California, Berkley
1970 Dr. Richard D. O'Brien, Cornell University
1971 Dr. Robert L. Metcalf, University of Illinois
1972 Dr. Ralph L. Wain, Wye College, University of London, England
1973 Dr. Hubert Martin, British Crop Protection Council, England
1974 Dr. T. Roy Fukuto, University of California, Riverside
1975 Dr. Michael Elliot, Rothamsted Experiment Station, England
1976 Dr. Morton Beroza, USDA-ARS (retired)
1977 Dr. Francis A. Gunther, University of California, Riverside
1978 Dr. Julius J. Menn, Stauffer Chemical
1979 Mr. Milton S. Schecter, USDA (retired)
1980 Dr. Minuro Nakajima, Kyoto University, Kyoto, Japan
1981 Dr. Philip C. Kearney, USDA-ARS, Beltsville, Maryland
1982 Dr. Jack R. Plimmer, USDA-ARS, Beltsville, Maryland
1983 Dr. Karl Heinz Buechel, Bayer AG, Germany
1984 Dr. Jacques Jean Martel, Roussel Uclaf, Paris
1985 Dr. Junshi Miyamoto, Sumitomo Chemical Co., Japan
1986 Dr. James Tumlinson, USDA-ARS, Gainesville, Florida
1987 Dr. Fumio Matsumura, Michigan State University
1988 Dr. Ernest Hodgson, North Carolina State University
1989 Dr. Toshio Narahashi, Northwestern University
1990 Dr. David Schooley, University of Nevada, Reno
1991 Dr. Stuart Frear, USDA-ARS, Fargo, North Dakota

PAST WINNERS OF THE ACS INTERNATIONAL AWARD FOR RESEARCH IN AGROCHEMICALS

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1992 Dr. Bruce Hammock, University of California, Davis
1993 Dr.Morifuso Eto, Kyushu University, Fuoka, Japan
1994 Dr. Toshio Fujita, Kyoto University, Kyoto, Japan
1995 Dr. Mohyee Eldefrawi, University of Maryland, Baltimore
Dr. Koji Nakanishi, Columbia University, New York
1996 Dr. Günther Voss, Ciba, Basel, Switzerland
Dr. Klaus Naumann, Bayer, Leverkusen, Germany
1997 Dr. Fritz Führ, Jülich, Germany
Dr. Izuru Yamamoto, University of Tokyo, Japan
1998 Dr. George Levitt, DuPont, Wilmington, Delaware
Dr. Leslie Crombie, University of Nottingham, England
1999 Dr. Don Baker, Zeneca, Richmond, CA
Dr. James Seiber, University of Nevada, Reno
2000 Dr. George P. Georghiou, University of California, Riverside
Dr. Herbert B. Scher, Zeneca
2001 Dr. Donald Crosby, University of California, Davis
Dr. Ralph Mumma, Pennsylvania State University
2002 Dr. Keith Solomon, University of Guelph, Ontario, Canada
Dr. Marinus Los, American Cyanamid
2003 Dr. Bob Hollingworth, Michigan State University
Dr. Hideo Ohkawa, Kobe University, Japan
2004 Dr. Stephen Duke, USDA-ARS, Oxford, Mississippi
Dr. John Marshall Clark, University of Massachusetts
2005 Dr. Robert Krieger, University of California, Riverside
Dr. Janice E. Chambers, Mississippi State University
2006 Dr. Joel Coats, Iowa State University
Dr. Isamu Yamaguchi, Agricultural Chemicals Inspection Station, Tokyo Japan
2007 Dr. Gerald T. Brooks, West Sussex, UK
Dr. Fredrick J. Perlak, Monsanto
2008 Dr. David M. Soderlund, Cornell University
2009 Dr. R. Donald Wauchope, USDA-ARS, Tifton, Georgia

CALL FOR NOMINATIONS
ACS INTERNATIONAL AWARD FOR RESEARCH IN AGROCHEMICALS

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The ACS International Award for Research in Agrochemicals is given to a scientist who has made outstanding contributions to the field of agrochemicals at the international level. Their vision and sustained contributions will have opened new horizons for other investigators in their field and beyond.

- The ***nomination letter*** will include the following statement: "I hereby nominate [insert first, middle, last name] as a candidate for the ACS International Award for Research in Agrochemicals." It will also include the ***nominee's birthplace, date of birth, citizenship, business address*** and a **description** (200 – 1000 words) of the reasons why the nominee should receive this award, stressing the individual's major accomplishments.

- Include a ***curriculum vitae*** of the candidate that includes: places and nature of employment, professional affiliations, honors and awards received, and a list of publications and patents.

- Nominations often include ***one or two letters of support***, although this is optional.

- Please provide 11 copies.

Deadline: Nominations should be received by the committee chair by ***December 31*** of each year. Balloting will be conducted in January/February and results will be announced in the spring of the following year.

The nominating official(s) should be prepared to assist in organizing a symposium at the National ACS meeting in honor of the awardee.

Please, return this completed form to:

Dr. James Seiber, Chair
Food Science Department
University of California
One Shields Avenue
Davis, CA 95616-8598
530-752-1465 – phone
jnseiber@ucdavis.edu

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1981 Norman E. Borlaug, Nobel Laureate and Director of International Maize and Wheat Improvement Center, Mexico City

1982 Warren L. Butler, Professor of Biology and Past Chairman, Biology Department, University of California at San Diego

1983 Melvin Calvin, Nobel Laureate and University Professor of Chemistry, University of California at Berkeley

1984 Frederick Ausubel, Professor of Genetics, Harvard Medical School and Massachusetts General Hospital

1985 Alan Putnam, Professor, Department of Horticulture and Pesticide Research Center, Michigan State University

1986 Ralph Hardy, President, Boyce Thompson Institute for Plant Sciences, Cornell University, and Deputy Chairman, BioTechnica International

1987 Mary-Dell Chilton, Director of Biotechnology Research for Ciba-Geigy Corporation, Research Triangle Park, North Carolina

1988 Bruce N. Ames, Chairman, Department of Biochemistry, University of California at Berkeley

1989 Sanford A. Miller, University of Texas Health Science Center at San Antonio

1990 Roy L. Whistler, Emeritus Professor, Purdue University

1991 Peter S. Eagleson, Professor of Civil Engineering, Massachusetts Institute of Technology

1992 John E. Casida, Professor of Chemistry and Toxicology, University of California at Berkeley

1993 Philip H. Abelson, Deputy Editor, *Science*, and Scientific Advisor to AAAS

1994 Wendell L. Roelofs, Liberty Hyde Bailey Professor of Insect Biochemistry, Cornell University

1995 Winslow R. Briggs, Director Emeritus, Department of Plant Biology, Carnegie Institution of Washington

1996 Hugh D. Sisler, Professor Emeritus, Department of Plant Biology, University of Maryland

1997 Ernest Hodgson, Head, Department of Toxicology, North Carolina State University

1998 Martin Beroza, Chief, Organic Chemicals Synthesis Laboratory, Agricultural Research Service

1999 Bruce D. Hammock, Professor, Department of Entomology, University of California at Davis

2000 William S. Bowers, Professor, Department of Entomology and Chemical Ecology, University of Arizona

2001 Malcolm Thompson, Research Chemist, USDA-ARS, Beltsville, Maryland (retired)

2002 Ervin E. Leiner, Professor Emeritus, Biochemistry Department, University of Minnesota

2003 Kriton Kleanthis Hatzios, VA Agricultural Experiment Station

2004 Robert L. Buchanan, Food & Drug Administration

2005 Donald L. Sparks, Plant and Soil Sciences, University of Delaware

2006 Stanley B. Prusiner, Institute for Neurodegenerative Diseases, University of California, San Francisco

2007 Bruce E. Dale, Department of Chemical Engineering & Materials Science, Michigan State University

2008 Fergus M. Clydesdale, Department of Food Science, University of Massachusetts, Amherst

2009 Charles J. Arntzen was appointed to the Florence Ely Nelson Presidential Endowed Chair at Arizona State University (ASU) in Tempe

Sterling B. Hendricks Memorial Lectureship Award
CALL FOR NOMINATIONS

Co-Sponsored by the AGRO & AGFD Divisions

The USDA-Agricultural Research Service (ARS) is seeking nominations for the 2011 Sterling B. Hendricks Memorial Lectureship Award. This Lectureship was established in 1981 by ARS to honor the memory of Sterling B. Hendricks and to recognize scientists who have made outstanding contributions to the chemical science of agriculture. Dr. Hendricks contributed to many diverse scientific disciplines, including soil science, mineralogy, agronomy, plant physiology, geology, and chemistry. He is most frequently remembered for discovering phytochrome, the light-activated molecule that regulates many plant processes. The lecture should address a scientific topic, trend, or policy issue related to agriculture. Deadline is **November 3, 2010.**

The AGRO Division and the Agricultural & Food Chemistry Division (AGFD) co-sponsor the Lecture which will be held in a joint session of these divisions. The lectureship is presented at an AGFD symposium in even-numbered years and in an AGRO symposium in odd-numbered years. The award includes an honorarium of $2000, a bronze medallion, and expenses to attend the meeting.

Nominees will be outstanding senior scientists in industry, universities, consulting, or government positions. *Current ARS employees are not eligible.* The Award will be presented during an American Chemical Society National Meeting held in 2011 in Denver prior to the Lecture. Giving the presentation is a requirement of the honor.

The **Nomination Package** includes:

- A letter explaining the nominee's contributions to chemistry and agriculture,
- A current *curriculum vitae* (hard copy only)

Nomination letters may be sent electronically to:

Kim Kaplan, Lecture Coordinator
kim.kaplan@ars.usda.gov

Hard copy nominations and *curriculum vitae* are to be submitted via courier to:

Kim Kaplan, Lecture Coordinator
ARS Information Office
Room 1-2253, Mail Stop #5128
5601 Sunnyside Ave
Beltsville, MD 20705
301-504-1637 – phone

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CALL FOR NOMINATIONS
AGRO NEW INVESTIGATOR AWARD

Sponsored by Dow AgroSciences

The AGRO Division seeks nominations for the New Investigator Award to be awarded at the ACS meeting in Denver, Colorado in August 2011. The purpose of the New Investigator Award is to recognize scientists who have obtained a doctoral degree and are actively conducting academic, industrial, consulting, or regulatory studies.

The Division is interested in work on all aspects of agrochemicals which are broadly defined to mean pesticides of all kinds (e.g., chemical pesticides, biopesticides, pheromones, chemical attractants, fumigants, plant incorporated protectants, disinfectants) as well as biotechnology-derived crops (e.g., Bt crops, Roundup Ready crops, etc.). Studies of veterinary pharmaceuticals and antibiotics are included in the Division's mission.

AGRO is also interested in chemical products made from agricultural commodities and byproducts including biofuels and the issues surrounding production. The categorical areas of study related to agrochemicals are very broad and encompass environmental chemistry, toxicology, exposure assessment, risk characterization, risk management, and science policy. The Division especially encourages submissions related to public health protection as well as crop, livestock, aquaculture, and wildlife protection.

- *To be eligible for the award, the scientist must have obtained his or her doctorate no more than five years before the time of the Fall ACS national meeting.* Thus, for 2011, applications will be considered from scientists who have obtained their doctorates no earlier than the year 2006.
- The award winner will be expected to deliver an oral presentation in their area of interest in one of the AGRO Program sessions.
- The award winner will receive a $1000 honorarium, a commemorative plaque, one-year complementary membership in the AGRO Division, a meeting registration fee waiver, and reimbursement for travel expenses in association with the DC meeting.

Applications for the New Investigator Award will consist of the following elements:

1. Submission of a maximum **five-page paper describing the area of research** or other work relevant to the broad mission of the AGRO Division. The paper may be structured as a research paper (i.e., contains the main elements of a typical journal article) or as a critical review of one's particular contributions to the scientific fields covered by the AGRO Division.
2. Submission of a **150 word abstract** for the submitted paper.
3. Submission of at least **one letter of recommendation** from a current supervisory scientist (e.g., a business manager, a departmental chair, etc.)
4. Both the paper (pdf format only) and letter of recommendation should be **submitted no later than March 15, 2011** to Cathleen Hapeman, via email, cathleen.hapeman@ars.usda.gov, for consideration of an award at the Fall meeting in Denver.

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Wednesday 12:00 – 1:00 pm
The Moscone Center Room 3005 West Building

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2009 AGRO EDUCATION AWARDS AT WASHINGTON DC

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Congratulations to last year's winners!

DANIEL SWALE is beginning his PhD in Insect Neuro-toxicology with Dr. Jeffrey Bloomquist in the Department of Entomology at the University of Florida. He earned his Bachelors degree from Christopher Newport University and his Masters (MSc.) degree from Virginia Tech in 2008 and 2009, respectively. His masters research was also performed under the direction of Dr. Jeffrey Bloomquist and was based around determining allosteric solvent effects between acetylcholinesterase and mosquito selective carbamates. His dissertation research will follow a similar topic and will be on the development of selective carbamates for mosquito control, specifically the malaria vector, *Anopheles gambiae*. Aside from science, Daniel also enjoys a variety of extracurricular activities such as triathlons, fishing, and hunting.

AARON GROSS is currently completing a master's degree in Toxicology with Dr. Joel Coats at Iowa State University. The focus of his M.S. work is investigating the toxicology of monoterpenoids at the insects' octopamine receptor. This work includes the development of a high-throughput system where an octopamine receptor is expressed in yeast cells. He received his B.S. degree in Biochemistry and Biomedical Sciences at St. Cloud State University, St. Cloud, MN. He plans to pursue a doctorate with Dr. Coats.

JAMES MUTUNGA is finishing his PhD in Neurotoxicology with Dr. Jeffrey Bloomquist at the Department of Entomology, Virginia Tech. He earned both his Masters and Bachelors degree in Biochemistry from the Jomo-Kenyatta University of Agriculture and Technology (JKUAT)-Kenya, in 2000 and 2005 respectively. His dissertation research is on the characterization of highly selective carbamates for mosquito control with special focus on unraveling acetylcholinesterase enzyme-ligand interactions at the target site. After his PhD, he hopes to further his research in insecticide toxicology with major focus on both existing and new insecticide target proteins, in a systematic search for new target sites that would complement the existing ones. With current advances in comparative genomics, proteome analysis and molecular modeling, we can characterize to a greater detail new multi-target or bivalent ligands that are more effective inhibitors and less harmful to non-target species, especially vertebrates. More so, resistance development confers a fitness cost to insect disease vectors, an insecticide that has multiple selective targets to a pest species or disease vector will not only be effective but also unlikely to select for resistance.

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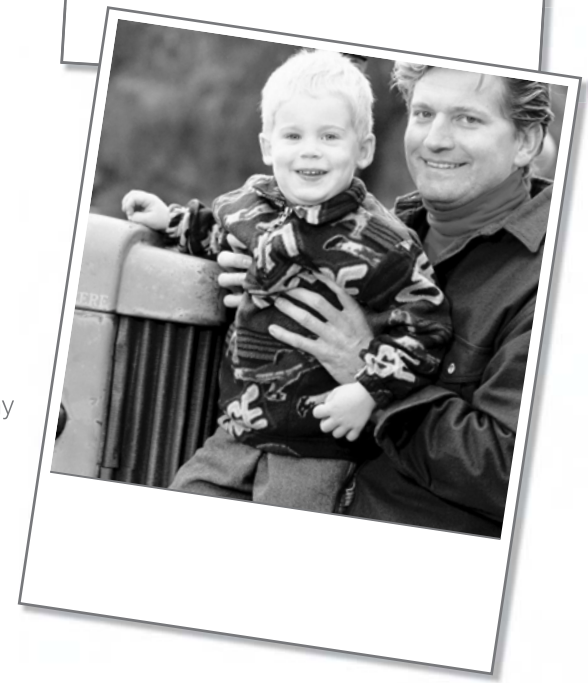

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2010 AGRO EDUCATION AWARDS FOR STUDENT TRAVEL

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Congratulations to all our travel grant winners!

First and second place winners will be announced at the AGRO Awards & Social on Tuesday evening.
Abstracts can be found beginning on page

E. U. Asogwa. Evaluation of novel insecticide (Proteus 170 O TEQ) for the routine protection of cocoa farms against the brown cocoa mirid (*Sahlbergella singularis*) in Nigeria. *Department Of Crop Protection, Cocoa Research Institute Of Nigeria, Ibadan, Oyo State, Nigeria.* AGRO 173

L. Chen, C. Pan, R. I. Krieger, Residue dynamics of procymidone in leeks and soil in greenhouses by smoke generator application. *Department of Entomology, University of California, Riverside*. AGRO 179

Z. Chen, A. Joseph, L. Cui, and R. I. Krieger. DDA excretion in chickens following low level DDT feeding. *Department of Entomology, University of California, Riverside.* AGRO 176

A. D. Gross, M. J. Kimber, P. Ribeiro, J. R. Coats. Development of a high throughput assay to screen natural insecticides: A green chemistry approach to targeting an α-adrenergic-like octopamine receptor from the American cockroach. *Department of Entomology, Iowa State University*. AGRO 186

D. R. Hall, D. W. Boerth. Adducts from reactions of aryloxyacetic/propanoic acid herbicides with DNA in plants. *Department of Chemistry and Biochemistry, University of Massachusetts-Dartmouth*. AGRO 185

A. M. Jessick, T. B. Moorman, J. R. Coats. Environmental fate of erythromycin in aquatic microcosms. *Department of Entomology, Iowa State University*. AGRO 187

W. Jiang, J. Gan, D. Haver, F. Spurlock. Sorption and desorption of ^{14}C-labeled permethrin on concrete. Department of Environmental Sciences, University of California, Riverside. AGRO 189

Y. Jiang, F. Ekström, P. Carlier, J. Hartsell, M. Ma, J. R. Bloomquist. Evaluation of new carbamate insecticides for neurotoxicity to non-target species. *Department of Entomology, Virginia Polytechnic Institute and State University*. AGRO 177

A. Karnjanapiboonwong, A. N. Morse, T. A. Anderson. Uptake of 17α-ethynylestradiol and triclosan into plants. *Department of Environmental Toxicology, Texas Tech University.* AGRO 174

D. J. Previte, H. E. Hodgdon, K. S. Yoon, H. J. Kim, G. E. Abo El-Ghar, S. H. Lee, J. M. Clark. Serial invasive signal amplification for the determination of *kdr* allele frequencies in global human head louse populations for efficient resistance monitoring. *Department of Molecular and Cellular Biology, University of Massachusetts-Amherst*. AGRO 181

G. Sankaran, Y. Li, Z. Chen, T. Lopez, L. Cui, W.-G. Song, H. Vega, R. I. Krieger. Rubber latex gloves as a potential dermal dosimeter for measuring multiple pesticide residues in strawberry harvesters. *Department of Entomology, University of California, Riverside.* AGRO 180

J. D. Sivey, A. L. Roberts. Abiotic reduction of dichloroacetamide safeners: Transformations and fate of "inert" agrochemical ingredients. *Department of Geography and Environmental Engineering, Johns Hopkins University.* AGRO 172

J. M. Sonn, T. D. Anderson. Community-assisted approach to managing host-pathogen interactions of mosquitoes and amphibians in nitrogen-enriched agricultural landscapes. *Department of Biology, The University of Texas at Tyler.* AGRO 183

J. P. Strycharz, S. H. Lee, W. Sun, B. R. Pittendrigh, J. M. Clark. RNAi knockdown of ABC transporters causes decreased tolerance to DDT in the highly DDT-resistant *91-R* strain of *Drosophila melanogaster*. *Veterinary and Animal Science, University of Massachusetts, Amherst.* AGRO 182

D. Swale. Experimental evidence for allosteric solvent effects between mosquito-selective carbamates and the malaria vector, A*nopheles gambiae*. *Department of Entomology, Virginia Polytechnic Institute and State University.* AGRO 175

F. Tong, J. R. Coats. Effects of carvacrol and nootkatone on [^{14}C]-nicotine binding to the house fly nicotinic acetylcholine receptor. *Department of Entomology, Iowa State University*. AGRO 184

J. Tso, S. Inamdar, D. S. Aga. Simultaneous analysis of sulfonamides, tetracyclines, and free and conjugated estrogens in an agricultural watershed by LC/MS/MS. *Department of Chemistry, University at Buffalo, Buffalo, NY.* AGRO 178

Special thanks to our sponsor for their generous contribution!

Bayer CropScience

CALL FOR APPLICANTS
AGRO Education Awards
Sponsored by Bayer CropScience

UNDERGRADUATE & GRADUATE STUDENT RESEARCH
SUPPORT FOR POSTER PRESENTATIONS
AT THE 2011 FALL MEETING IN DENVER, COLORADO

The AGRO Division has established an endowment fund that will be used to promote an understanding of the role of chemistry in agriculture. To address this goal, awards will be made through the Division's Education Committee

Proposals are sought for the 2011 awards. Undergraduate and graduate students will be awarded up to $600 each to help defray costs of attendance to give poster presentations at the ACS 2011 Fall Meeting, which will be held August 28 - September 1, 2011, Denver, Colorado. Posters will be displayed in a special poster session of the ACS Division of Agrochemicals. First, Second and Third place winners will receive an additional cash award.

The subject of the presentation should pertain to the chemistry of the AGRO Division Topics should relate to pest management chemistry including synthesis, metabolism, regulatory, biotechnology, delivery, risk assessment, resistance, residues, mode of action, fate/behavior/transport, and agronomic practices. The AGRO Division is also interested in chemical products made from agricultural commodities and byproducts including biofuels and the issues surrounding production.

To apply, a graduate student should submit the following to be received no later than March 15, 2011 (OASYS Deadline):

1. An abstract formatted according to the directions given on the ACS website. Be sure to include name (of applicant), address, and e-mail address.

2. A two page extended abstract giving more detail of the research/presentation.

3. A short letter of nomination from the faculty advisor.

Submit items 1 and 2 to the ACS OASYS abstract submission website.
http://abstracts.acs.org/

Submit item 3 as a Word or pdf file to Dr. John Johnston at john.johnston@fsis.usda.gov

Direct questions to:
Dr. John J. Johnston
USDA-FSIS
2150 Centre Ave.
Building D, Suite 320
Fort Collins, CO 80526
202-365-7175

Abstracts will be reviewed by the Education Committee.
Submitters will be notified of their selection status in May 2011

Special thanks to our sponsor for their generous contribution!

Bayer CropScience

AGRO Program Committee Report

The Program Committee is made up of the Division Officers, Executive Committee members, Standing members, Volunteer members, and a Long Range Program Coordinator to keep a continuous record of past and future programming. Some names are listed twice as they are serving in more than one category. If you have an interest in serving as a volunteer member of this committee, or if you would like more information on participating in AGRO programming, please contact Ken Racke, Joe Massey, or one of the division officers.

A list of standing topic areas was established which reflects better the broader areas of agricultural research being addressed by AGRO. These topics will be part of each AGRO program along with our normal awards, programming, and symposia to address ACS themes for each meeting and special topics of emerging or continuing interest.

If you have additional ideas for standing topics or programming that you would like to see included in AGRO, please contact one of the division officers.

AGRO Program Committee

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Keri Carstens	keri.carstens@pioneer.com		
Volunteer Members			
Steven A. Ripp	saripp@utk.edu		

Notes from the Program Chair

Ken Racke

The AGRO Division will host a diverse and truly outstanding program as part of the 239th National Meeting of the American Chemical Society in San Francisco during March 21-25, 2010. In addition to five award or celebration symposia, we have fourteen additional platform symposia and three combination poster sessions planned. They will run the gamut from synthesis to pest management best practices to environmental fate, human safety, and regulation. All AGRO technical and social sessions will be centrally located at the Moscone Convention Center.

In planning for San Francisco, we in AGRO knew that returning to this city where we have had some very successful programs was a great idea, so it was not a complete surprise when we had more than 360 abstracts accepted for the program – significantly exceeding our previous single-meeting records. Outlined below are a few highlights of the program the AGRO leadership team and symposium organizers have developed for the San Francisco meeting.

Awards and Celebrations – On Sunday, a symposium organized around *Advances in Discovery of New Agrochemicals* will feature an encore presentation by Dr. George Lahm, winner of the **Spencer Award**, as well as presentations by several recipients of the **ACS's Team Innovation Award**. Monday will feature the ***International Award*** *in Agrochemicals Research Symposium* for Dr. Shinzo Kagabu concerning neonicotinoid insecticide research and the New Investigator Award honoring Dr. Kyong Sup Yoon. The ***Sterling B. Hendricks*** *Memorial Lecture* will be presented this year to Dr. Chris Somerville during a Tuesday midday celebration organized by AGFD. A symposium planned for Tuesday and Wednesday will celebrate Dr. John Casida and his research contributions over the last 60+ years with alumni and colleagues from California and around the world presenting lectures in his honor.

Platform Sessions – We have fourteen additional oral symposia that will run wall-to-wall from Sunday morning, March 21, through Thursday afternoon, March 25. Three symposia involving nearly 70 presentations have been organized around **water quality** topics including *Pesticide Mitigation Strategies for Surface Water Mitigation*, *Pesticides and Urban Water Quality: Monitoring, Modeling, and Mitigation*, and *Emerging Contaminants in California's Coastal and Estuarine Ecosystems*. Several hot-topic symposia on **regulatory science** have been organized, including *Push for Greener Formulations: Evolving Regulatory Framework for Inerts and Co-Formulants*, *Assessing Exposure of Pollinators to Systemic Pesticides*, and *Increasing the Utility of Terrestrial Field Dissipation Data*. **Human safety** considerations will be highlighted in the following symposia, *Pesticides in Urban Settings and Aggregate Human Exposures* and *Contemporary Food Safety Issues: Mitigating Risks from Production to Processing*. Symposia on management practices include *Comparing Conventional and Biotechnology-Based Pest Management, Invasive Species: Is Chemistry up to the Task?, Efficient Application of Pesticides for Sustainable and Effective Crop Protection*. The third in a series of symposia organized during past years on modern chiral pesticides will occur in San Francisco, this one focuses on *Enantioselectivity and its Consequences*. Finally, new area sypomsia of expanding interest for AGRO are *Understanding Greenhouse Gases from Agriculture* and *Advances in Biofuels and Bioproducts: Life Cycle Analysis and Sustainability*.

Poster Sessions – We have three excellent poster sessions scheduled as a complement to our platform sessions, and our 80 AGRO posters have been grouped into three sessions one each on Monday, Tuesday, and Wednesday from 9:30 AM to 4 PM. Monday's session will include posters for the *General Session*, *Biofuels and Bioproducts*, *Urban Pesticide Exposures*, and *Greenhouse Gases from Agriculture*. Tuesday's session will feature our *Graduate Student Award Posters*, as well as posters on *Surface Water Mitigation*, *Pesticides and Urban Water Quality*, and *Environmental Fate*. Wednesday's session will include posters from the *Casida and Friends Celebration* as well as the topics *Chiral Pesticides* and *Emerging Coastal Contaminants*. A selection of the best of show posters from AGRO will also appear as part of the ACS-wide SCI-MIX event planned for Monday evening. Please note that we are trying something **new this year** with our poster sessions. All AGRO coffee and refreshments will be served during morning and afternoon breaks in our poster session room, so wander by during one of these breaks for a **cup of java to go along with your poster browsing!**

Business and Social Events – Do you want to get to know more of the AGRO crowd or advance your ideas for future scientific symposia or other Divisional activities? Come join us at one of the outstanding business/social events we have planned in San Francisco. Our combined annual **program and business meeting** is open to all and will be held on Sunday evening beginning at 5:00 PM (heavy appetizers/finger foods will be served). On Tuesday, the traditional **AGRO Social and Mixer** will begin at 6:00 PM for AGRO members and guests. Come for snacks and drinks and also an opportunity to greet our awardees. On Wednesday evening beginning at 5:00 PM, join us for our **Blues and Brews Future Programming Brainstorm Mixer**. Along with enjoying snacks and drinks, tips on how to organize a symposium will be shared, and you will have the opportunity to volunteer or make your nominations for symposium topics to be organized at future meetings.

Planned AGRO Programming & Outreach Activities 2010 – 2012

Activity/Event	Leader(s)	Status	Actions Required
IUPAC Pesticide Congress Summer 2010 Melbourne, Australia July 4-8, 2010	Don Wauchope, Hisashi Miyagawa	• Accepting papers for meeting • Many AGRO members are serving on technical program committees	**Abstract Deadline** • Posters March 19, 2010 • Early bird Registration ends April 26, 2010 • Visit website for more information www.iupacicpc2010.org
47th Florida Pesticide Residue Workshop St. Pete Beach, Florida USA July 18-21, 2010	Steve Lehotay	• Accepting papers for meeting	**Abstract Deadline** • Oral May 1, 2010 • Poster June 1, 2010 • Visit website for more information www.flworkshop.com
Pacifichem 2010 Honolulu, Hawaii December 15-20, 2010	John Johnston	• Two symposia will be sponsored by AGRO	**Abstract Deadline** • April 5, 2010 • Visit website for more information www.pacifichem.org
Activities beyond 2010			
242nd ACS National Meeting August 28-September 1, 2011 Denver, Colorado	Al Barefoot	• Symposia planning at Blues and Brews on Wednesday, March 24	• Submit symposia proposals (in Call for Papers format) to Al Barefoot August 1, 2010 for inclusion in Fall 2010 PICOGRAM • Submit papers by March 15, 2011
48th Florida Pesticide Residue Workshop July 2011	Steve Lehotay	• Program under development	
5th Pan-Pacific Conference in Pesticide Science Tsukuba, Japan July 8-12, 2012	H. Matsumoto, Ken Racke, Laura McConnell, John Johnston	• Meeting under development with Pesticide Science Society of Japan as lead	
244th ACS National Meeting Philadelphia, Pennsylvania August 19-23, 2012	2011 Vice Chair	• Symposia planning at Blues and Brews on Wednesday, March 24	• Submit symposia proposals (in Call for Papers format) to Program Chair May 1, 2011 for inclusion in Fall 2011 PICOGRAM

Standing Program Topics

- Environmental Fate, Transport, Risk Assessment and Modeling of Agriculturally-Related Chemicals
- Technological Advances and Applications in Agricultural Science: Nanotechnology, Genetically Modified Organisms, and Biocontrol Agents
- Development of Value-Added Products from Agricultural Crops and Byproducts
- Bioenergy and Biofuels from Agriculture
- Natural Products, Pheromones, and Chemical Signaling in Agriculture
- Synthesis of Bioactive Compounds
- Residue and Metabolism Chemistry
- Advances in Agrochemical Residue and Metabolism Chemistry
- Human and Animal Health Protection: Veterinary Pharmaceuticals, Antimicrobials, Worker Protection Products
- Urban Agriculture – Turf, Ornamentals, Household Products, and Water Re-Use
- Developments in Integrated Pest Management and Resistance Management
- Soil and Nutrient Management for Sustainable Agriculture
- Agrochemical Toxicology and Mode of Action

Future ACS National Meetings

240th ACS National Meeting & Exposition
August 22-26, 2010, Boston, Massachusetts

241st ACS National Meeting & Exposition
March 27-31, 2011, Anaheim, California

242nd ACS National Meeting & Exposition
August 28 – Sept. 1, 2011, Denver, Colorado

243rd ACS National Meeting & Exposition
March 25-29, 2012, San Diego, California

244th ACS National Meeting & Exposition
August 19-23, 2012, Philadelphia, Pennsylvania

245th ACS National Meeting & Exposition
April 7-11, 2013, New Orleans, Louisiana

246th ACS National Meeting & Exposition
September 8-12, 2013, Indianapolis, Indiana

247th ACS National Meeting & Exposition
March 16-20, 2014, Washington, DC

248th ACS National Meeting & Exposition
August 24-28, 2014, San Francisco, California

249th ACS National Meeting & Exposition
March 22-26, 2015, Denver, Colorado

250th ACS National Meeting & Exposition
August 16 - 20, 2015, Boston, Massachusetts

251st ACS National Meeting & Exposition
March 13 - 17, 2016, San Diego, California

252nd ACS National Meeting & Exposition
August 21 - 25, 2016, Philadelphia, Pennsylvania

253rd ACS National Meeting & Exposition
April 2 - 6, 2017, San Francisco, California

254th ACS National Meeting & Exposition
September 10 - 14, 2017, St. Louis, Missouri

255th ACS National Meeting & Exposition
March 18 – 22, 2018, New Orleans, Louisiana

256th ACS National Meeting & Exposition
August 19 – 23, 2018, Boston, Massachusetts

257th ACS National Meeting & Exposition
March 31 - April 4, 2019, Orlando, Florida

258th ACS National Meeting & Exposition
August 25 – 29, 2019, San Diego, California

You Are Cordially Invited To:

AGRO Brainstorming, Blues & Brews

Happy Hour

Wednesday 5:00 – 7:00 PM
The Moscone Center – Room 3009 West Bldg

- **Share your ideas about the future AGRO programming**
- **Learn more about organizing a symposium**
- **Let us know what topics are the most important to you**

Free refreshments will be served

ALL ARE WELCOME!

Call for Symposia Proposals
For 2011 Programming

242nd ACS National Meeting & Exposition
ACS Theme: Chemistry of Air, Space and Water
August 28 – September 1, 2011
Denver, Colorado

AGRO anticipates an exciting and diverse technical program in Denver, Colorado at the 2011 Fall National Meeting. However, we need additional symposia proposals and volunteers for organizing symposia to come forward at this time.

A tentative listing of symposia being considered for Denver is listed below. Please submit your additional ideas to 2011 AGRO Program Chair Al Barefoot: 302-451-5856 or aldos.c.barefoot@usa.dupont.com.

Award Symposia Planned

AGRO International Award for Research in Agrochemicals
Sponsored by BASF and DuPont

Sterling B. Hendricks Memorial Award
Sponsored by USDA-ARS
Cosponsored by AGFD
Organizer: Stephen Duke, USDA-ARS
622-915-1036
stephen.duke@ars.usda.gov

AGRO New Investigator Award
Sponsored by Dow AgroSciences
Organizer: Cathleen Hapeman, USDA-ARS 301-504-6451
cathleen.hapeman@ars.usda.gov

AGRO Education Awards for Undergraduate and Graduate Student Travel: Research Poster Presentations
Sponsored by Bayer CropScience
Organizer: John J. Johnston, USDA-FSIS 202-365-7175
john.johnston@fsis.usda.gov

Early Ideas and Suggestions for Technical Symposia

Additional proposals or expressions of interest in any of these initial ideas are invited.

Access to Global Requirements and Data Required for Global Registration of Pesticides
Chris Peterson, Don Wauchope

Advances in Estimation of Human Exposures via Drinking Water
Nick Poletika

Advances or Wild Goose Chase: The State of Endocrine Disruptor Screening and Evaluation

Agrochemicals Science and Risk Communication
Paul Hendley, John Johnston

Advances in Bioenergy and Bioproducts: LCA and Sustainability
Potential cosponsors ENVR, FUEL, AGFD
Cathleen Hapeman
cathleen.hapeman@ars.usda.gov

Analytical Challenges Associated with New Pesticide Classes
Cosponsored by ENVR
Organizers: Kevin Armbrust, Office of the State Chemist- Mississippi
662-325-3324
armbrust@mscl.msstate.edu
George Cobb, Texas Tech University
george.cobb@tiehh.ttu.edu

Better Models and Scenarios for Higher Tier Fate Assessments
Wenlin Chen

Characterization of Non-extractable Residues
Paul Francis, Kalumbu Malekani, Suresh Mislankar

Characterizing the Environmental and Carbon Footprint of Agriculture Throughout the Product Chain
Stuart Cohen

Chemical Partitioning at the Water/Sediment Interface

Dissemination of Information to Famers: Environmental Health Application of our Research

Evaluating Aquatic Exposure Model Performance in Relation to User Applications
Organizer: Michael Barrett, US EPA,
barrett.Michael@epamail.epa.gov

Fate Considerations for a Novel class of Legacy Pollutants: PFOS/PFOA
Cosponsored by SETAC

Formulations and Efficacy of Agrochemical Delivery Systems
Potential cosponsor POLY

How to Manage the Flood of Toxicology Data Requirements and Information from REACH and other new Regulations
Don Wauchope

Impacts of Chars as Soil Amendments in Agriculture
Tom Potter

Knowledge to Better Manage Farmer's Land
Alan Cessna

Modeling Agricultural Emissions
Potential Cosponsor US EPA, ENVR
Laura McConnell, Cathleen Hapeman, and Cody Howard
laura.mcconnell@ars.usda.gov

Modeling the Efficiency of Chemical Runoff Buffers
Qingli Ma

Post-Application Volatility of Pesticides and Human/Environmental Exposure Assessment

Soil Amendments, Biosolids, Fertilizers

Spencer Award Symposium
Cosponsored by AGFD

Stewardship Programs and Implications in Use of Crop Protection Products
Rod Bennett

The Endangered Species Act and Pesticides: How Do We Get the System to Work?
Ken Racke, John Johnston, Jeff Jenkins

The Significant Residue: Determining Pesticide Bioavailability in the Environment
Dan Tessier

Toxicological Relevance of Trace Environmental Residues: Is there Any?
Allan Felsot, Ellen Arthur

Turf Management Systems and Effect on Surface Runoff
John Johnston

Use of Exposure Modeling in Efficacy Evaluations
Don Wauchope

Vadose Zone Observations vs. Prediction of Pesticide Concentrations at the Regional, National, and Global Levels
Jack Barbash

Veterinary Pharmaceuticals: Environmental Fate Considerations
N. Chubb, Pfizer

Water and Air Fate Considerations for Agriculture
Cosponsored by USGS
Paul Hendley, Bob Gilliom

Announcing the

47th Annual Florida Pesticide Residue Workshop

Trade Winds Island Grand Resort
St. Pete Beach, Florida USA
July 18 - 21, 2010

Abstract Deadline
Oral Presentations – May 1
Poster Presentations – June 1

Opening Lectures:

- Michelangelo Anastassiades - Multiresidue method for difficult-to-detect pesticides
- Hans Mol - Simultaneous analysis of pesticides, drugs, mycotoxins, and pollutants
- Jonathan Friedan - How to save money and reduce the environmental footprint of your lab

www.FLworkshop.com

Enjoy the Casual Ambiance of the Gulf of Mexico Beach

12th IUPAC International Congress of Pesticide Chemistry

www.iupacicpc2010.org

4-8 July 2010
Melbourne Exhibition and Convention Centre
Melbourne, Australia

Deadline for Poster Abstracts March 19, 2010
Early bird Registration ends April 26, 2010
Please indicate "IUPAC member" when registering to receive reduced rate

Conference Themes include:

- *Pest Management and Crop Protection*— chemical ecology, crop protection in the GM crop era, natural products, biopesticides, mode of action & metabolism, discovery of new pesticides, resistance management
- *Emerging Issues for Industry* — global warming, drought tolerant crops, biofuels, GM crops
- *Regulatory and Residue*— international harmonization for determining maximum residue limits (MRLs) for pesticides; examination of CODEX; interaction of politics and science of risk assessment
- *Formulation and Delivery*— current and future trends in formulation; delivery of biopesticides and natural products; pesticide quality; application technology; uptake and translocation
- *Environmental Fate and Safety Assessment*—pesticide risk assessment and mitigation; endangered species; evaluation of best management practices; advances in simulation of pesticide fate and transport; using GIS tools and remote sensing; pesticide use in developing countries

Hosted by

THE ROYAL AUSTRALIAN CHEMICAL INSTITUTE INCORPORATED

Chemistry serving Australia

AGRO Symposia at

Pacifichem 2010

www.pacifichem.org

December 15 – 20, 2010

Honolulu, Hawaii, USA

2010 International Chemical Congress of Pacific Basin Societies

More than 215 symposia are planned for this event!

ABSTRACT SUBMISSION: JANUARY 1 – APRIL 5, 2010

International Food Safety Issues & Opportunities (Saturday Dec 18)

International trade of food commodities is reliant upon alignment of safety standards of trade partners. Agreement (harmonization) of acceptable maximum residue levels (MRLs) of pesticides, drugs and other contaminants in vegetable and meat products helps to minimize trade barriers. The analytical methodology to quantify such residues and contaminants in foods also needs to be harmonized to ensure consistent monitoring and enforcement of regulations. Alignment of exposure and risk analysis approaches facilitates the development of regulatory standards for pesticides, drug residues, and contaminants in foods. Analytical methodology, risk assessment approaches, risk analysis results, and current toxicology and chemistry based issues which are pertinent to the safety and trade of imported foods and agricultural products are invited.

Rodenticide-Based Opportunities for Protection of Agriculture, Ecosystems and Public Health (Friday Dec 17)

Rodents cause significant damage to agriculture, native ecosystems and vector zoonotic diseases with significant negative public health impact. Development and application of chemistry based techniques for management of pest rodents is particularly challenging as selectivity is paramount - non-target impacts on other mammalian or avian species are unacceptable. This symposium will focus on synthesis, formulation, metabolism and environmental chemistry aspects of rodenticides. Techniques for estimating, monitoring and minimizing non-target impacts will be presented. Opportunities for applying chemistry based rodenticides to protect agriculture, native ecosystems and public health will also be presented.

For more information on the AGRO Pacifichem 2010 symposia contact John Johnston at
John. Johnston@fsis.usda.gov

AGRO Division Officers

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Division Chair

Dr. Kenneth D. Racke
Program Chair

Dr. Aldos C. Barefoot
Vice Chair

Dr. John J. Johnston
Treasurer

Dr. Liliana Schwartz
Secretary

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Joe Massey	Cathleen Hapeman	Rodney Bennett
Ken Racke	Keri Henderson	Allan Felsot
Pamela Rice	Ann Lemley	Laura McConnell
Scott Yates	Chris Peterson	Sharon Papiernik

COUNCILORS		
2009 – 2011	**Alternates**	
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Don Wauchope	Barry Cross	

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Rodney Bennett – Books	Tom Potter – Femtogram Editor		
Jay Gan – Abstracts Editor	Sharon Papiernik – Awards Coordinator		

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(Continued)

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Robert Hollingsworth			
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John J. Johnston, **Chair**	202-365-7175		john.johnston@fsis.usda.gov
John Bourke, **Investment Coordinator**			
Allan S. Felsot, **New Investigator Award Coordinator**	509-372-7365	FAX: 509-372-7460	afelsot@tricity.wsu.edu
Members			
David Barnekow	Barry Cross		Glenn Miller
John M. Clark	Vincent Hebert		Judd O. Nelson
Joel Coats	Ann Lemley		William Ridley

PROGRAM COMMITTEE LISTING

See page 28

Past Chairs of the Pesticide Chemistry/AGRO Division

1969	Donald G. Crosby	1983	G. Wayne Ivie	1997	Willis Wheeler
1970	Elvins Y. Spencer	1984	Robert M. Hollingsworth	1998	Judd O. Nelson
1971	Wendell Phillips	1985	John Harvey, Jr.	1999	Richard Honeycutt
1972	Philip C. Kearney	1986	Henry J. Dishburger	2000	Ann T. Lemley
1973	Roger C. Blinn	1987	James N. Seiber	2001	Jeffery Jenkins
1974	Charles H. Van Middelem	1988	Paul A. Hedin	2002	Terry D. Spittler
1975	Henry F. Enos	1989	Gustave K. Kohn	2003	Jeanette Van Emon
1976	Julius J. Menn	1990	Willa Garner	2004	Rodney Bennett
1977	James P. Minyard	1991	Guy Paulson	2005	Allan Felsot
1978	Gerald G. Still	1992	Joel Coats	2006	R. Donald Wauchope
1979	S.K. Bandal	1993	Larry Ballantine	2007	Laura L. McConnell
1980	Jack R. Plimmer	1994	Nancy N. Ragsdale	2008	John J. Johnston
1981	Marguerite L. Leng	1995	Don Baker	2009	Kevin L. Armbrust
1982	Gino J. Marco	1996	Barry Cross		

AGRO Strategic Plan
2009 Accomplishments & 2010 Plans

MISSION

The AGRO Division promotes knowledge benefiting society through advancements in agricultural, public health, and environmental science and technologies.

VISION FOR THE FUTURE

The AGRO Division will increase its recognition as a global leader in agriculture, public health, and environmental sciences by engaging and energizing its membership to foster global interactions that provide innovative solutions to challenges facing our world.

GOAL 1

Enhance the membership experience by providing accessible and innovative programs, educational products, mentoring and career services and opportunities for professional development and recognition.

Patricia Rice— patricia.rice@basf.com; 919-547-2668
Dan Stout— stout.dan@epa.gov; 919-541-5767

Accomplishments in 2009

- ✓ Graduate Student and Post Doctoral Luncheon held in Washington DC – Presentation from AAAS Science & Technology Policy Fellowship Program
- ✓ AGRO Education Awards for Undergraduate and Graduate Student Travel sponsored 15 students to attend the Fall 2009 National Meeting
- ✓ Continued with Electronic Balloting for the second year
- ✓ The second AGRO New Investigator Award was presented to Dr. Jennifer Anderson at the Fall 2009 National Meeting in Washington.
- ✓ New Facebook page initiated for AGRO
- ✓ Continued with development of new AGRO webpage.

Plans for 2010

- ♦ Complete development of the "Member-Get-A-Member" program
- ♦ Expand the AGRO Welcome Package information and circulation
- ♦ Complete review of membership survey feedback, document perceived needs, and develop action items
- ♦ Call non-active members to establish personal contact and invite and encourage participation
- ♦ Establish a jobs posting site on the AGRO webpage.
- ♦ Continue with Graduate Student Luncheon, and Early Investigator Award.
- ♦ Support more student-led symposia such as “Recent Developments in Invertebrate and Vertebrate Repellents” to be held at the Washington Meeting
- ♦ Explore avenues such as webcasts for selected symposia from National Meetings.

AGRO Strategic Plan
2009 Accomplishments & 2010 Plans

GOAL 2

Foster constructive interactions among diverse communities to provide solutions to agricultural, public health, and environmental concerns.

Joe Massey— jmassey@pss.msstate.edu; 662-325-4725
John Johnston— john.j.johnston@usda.gov; 202-365-7175

Accomplishments in 2009

- ✓ Successfully submitted two proposals for symposia at the 2010 International Chemical Congress of Pacific Basin Societies (Pacifichem) to be held in Honolulu, Hawaii, USA, December 15 - 20, 2010. The titles are: "International Food Safety Issues and Opportunities" and "Rodenticide-Based Opportunities for Protection of Agriculture, Ecosystems and Public Health."
- ✓ Sponsored symposium "Government Collaborations in Scientific Research, Regulations, and Communications" at the 2009 Fall National Meeting.

Plans for 2010

- ♦ Support development of novel programming such as "Government Collaborative Studies: Research and Regulations" to increase interactions among scientists of different groups.
- ♦ Emphasize building symposia and other programming which enhances interaction among communities to solve problems.

GOAL 3

Build the infrastructure for becoming a global center for solutions to problems of plant, animal, environmental, and public health protection, and advancing scientific and regulatory harmonization.

Chris Peterson— cjpeterson@fs.fed.us; 662-325-0199
John Johnston— john.j.johnston@usda.gov; 202-365-7175

Accomplishments in 2009

- ✓ Sponsor a special symposium at the Washington meeting "Challenges and Initiatives in Harmonizing Maximum Residue Levels (MRLs) across the World" and initiate the formation of a global expert network
- ✓ Sponsored a special symposium, "Agricultural Research in Australia: Critical Issues Leading up to the 12th IUPAC International Congress on Pesticide Chemistry in Melbourne" at the Fall National Meeting in Washington
- ✓ Co-sponsor 3rd International Workshop on Crop Protection Chemistry in Latin America in Rio de Janeiro, Brazil. Submitted Innovative grants proposal to expand the presence of AGRO at this conference and to sponsor a student poster award.

Plans for 2010

- ♦ Post summaries of recent symposia on the AGRO webpage.
- ♦ Increase interaction with IUPAC Division of Chemistry and the Environment through cooperative programming at international workshops and other cooperative projects.
- ♦ Participate in the 12th IUPAC International Congress on Pesticide Chemistry in Melbourne Australia.
- ♦ Sponsor two symposia at Pacifichem in Hawaii.

Minutes from the AGRO Division Business Meeting

238th ACS National Meeting
Washington, DC

August 16, 2009, 5:00pm – 9:00pm
Renaissance East, Renaissance Washington

Chair – Kevin Armbrust

I. Secretary's Report – Liliana Schwartz

- Secretary's report was presented at the last Business Meeting.
- 236th ACS National Meeting Philadelphia Minutes was prepared and distributed.
- Submitted 2008 Annual Report to ACS.
- Business meeting scheduled. Food ordered, conference room reserved.
- Award plaque for 2009 Chair was ordered.

II. Nominating Committee Report – Ellen Arthur

The results of 2010 AGRO Elections are:

- Chair Elect – Aldos Barefoot
- Secretary – Liliana Schwartz
- Treasurer – John Johnston
- Executive Committee Members
  - Laura McConnell
  - Allan Felsot
  - Rodney Bennet
  - Sharon Papiernick
  - Todd Anderson

III. Bylaws Committee Report – Rod Bennett

There are two recommendations:

- To review electronically the ballot and look for improvements.
- To update the Bylaws. Drafted document to be sent to the Executive Committee for approval.

IV. Councilor's Report – Don Wauchope & Jeanette VanEmmon

- This was our first Council Meeting as qualified voters, and it provided a glimpse into the workings of the large and complex combination of business enterprise and scientific society that is ACS! We were two of about 500 Councilors, about 70 from Divisions and the rest Local Section Counselors. We voted using hand-held electronic "clickers" which transmitted each individual voter's choices to a computer. The procedure seemed to work very well.
- PRESIDENT-ELECT AND DIRECTOR-AT-LARGE CANDIDATES SELECTED
  The Council selected Nancy B. Jackson and Cheryl A. Martin from four nominees, to be candidates for President-Elect. The Committee on Nominations and Elections selected four candidates for Director-at-Large, two of whom will be elected by mail ballot of Council in the fall. They are Dennis Chamot of the National Research Council; H. N. Cheng of Ashland Hercules Water Technologies, inc.; Ray A. Dickie, Consultant (Ford Motor Co., retired); and Valerie J. Kuck of the College of St. Elizabeth. Let us know if you have any comments on these candidates.
- REPORTS OF OFFICERS
  Reports were submitted by President Tom Lane, President-Elect Joe Francisco, Past President Bruce Bursten, Board of Directors Chair Judith Benham and Executive Director Madeline Jacobs.
- SUMARY OF MAJOR ISSUES
  - Impacts of bleak economy: Society is coping but assets have been hit hard
  - Small but steady declines in membership—we are about 160,000 currently with about a 10% turnover (losses and gains)
  - "ACS Fellow" program has been started: anyone may nominate, for service to the Society
  - ACS input to Obama Administration re-emphasis on science
  - "Branding": ACS logo including "Chemistry for Life" tag is available for general use by Divisions and Sections
  - Dues increase: we both voted against it, but the "yea's" were well in the majority.
  - 2011 will be the UN's International Year of Chemistry: ACS will plan to be very much involved and will also be working with IUPAC
  - Committee on Nominations and Elections had a petition approved for voting at the DC meeting: this is controversial, viewed by some as a move to stifle write-in candidacies. We don't have an opinion on this yet—input would be helpful.
  - The Board approved some changes in compensation to the ACS executive staff. We were notified of the action but the amounts are apparently confidential.

V. Finance Committee Report – Barry Cross

- Following the Philadelphia Meeting last August the financial markets underwent a free fall in values. This situation bottomed out in March

and since then there has been a steady recovery in the capital markets and in our AGRO Division finances. The reasons for this are three fold:

1. The AGRO Division had no alternative, but to enact severe cost cutting measures for 2009. To date our checking accounts remain stable, but until we get income and expenditures for this meeting we will not know how well we did.
2. We did not panic about the declining value of our investments, but retained our inventory in the Morgan AGRO Endowment.
3. This stock portfolio has regained its value steadily since last March. Nonetheless, the value on 6/30/09 had risen from year end value of $ 270,581 to $297,896, but has dropped from $387,213 on 6/30/08. This represents a loss of $90,000.

- For the year 2009 the financial measures taken must be adhered to. We can continue to expect a continuing improvement in the Endowment Value as the US and world economies begin to recover and expand. New budget guidelines should be held back till January 2010 when the full accounting of the finances can be properly assessed.

VI. Treasurer's Report – Terry Spittler

DATE	7/31/08	12/31/08	7/31/09
CHECKING ACCOUN T	$8,893	$16,826	$65,226
INVESTMENTS			
Spectrum Income (T. R. Price)	$173,566	$122,309*	$137,856
Prime Reserve (T. R. Price)	$1,310	$1,322	$1,328
Educational Trust (JPMorgan)	$380,902	$270,581	$317,627
ACS Investment Pool	$25,936	$21,096	$21,681
TOTAL INVESTMENTS	**$581,714**	**$415,308**	**$478,492**
TOTAL ASSETS	**$590,607**	**$432,134**	**$543,718**

*$40,000 to checking 8/22

AGRO Division Strategic Plan

Mission: AGRO Division promotes knowledge benefiting society through advancements in agricultural, public health, and environmental sciences and technologies.

Vision: AGRO division will increase its recognition as a global leader in agriculture, public health, and environmental sciences by engaging and energizing its membership to foster global interactions that provide innovative solutions to challenges facing our world.

Goal 1: *Enhance the membership experience by providing innovative programs, educational products, mentoring, and career services and opportunities for professional development and recognition.*

VII. Awards Committee Report – Jim Seiber & Cathleen Hapeman

- Dr. Donald Wauchope, USDA-ARS (retired) will receive the International Award for Research in Agrochemicals at the Fall, 2009 ACS Meeting.
- Dr. Charles Arntzen, Arizona State University is the recipient of the Sterling B. Hendricks Memorial Lectureship Award.
- Dr. Jennifer Anderson receives the New Investigator Award for her research concerning the mode of action of terpenoid repellency and toxicity.
- Dr. Shinzo Kagabu, Gifu University, Japan, receives 2010 International Award for Research in Agrochemicals.

VIII. Communications Committee Report – Cathleen Hapeman

- Several AGRO members have become much more active in the production of the even larger PICOGRAM. Jay Gan is now the abstracts editor and he needs symposium organizers to be much more diligent about editing their abstracts. Sharon Papiernik works with the awardees to ensure their write-up and pictures are received in time for production. Laura McConnell is coordinator for the ads and ensures the billing occurs in a timely fashion.
- PICOGRAM production costs and US mailing about $7500 without abstracts and $15K with abstracts. In 2008, production costs for 2 PICOGRAMs were $21,832 which was offset by ad revenues of $8550 affording a net cost of $13,282 to Division. Mailing the PICOGRAM to International members was an additional $3468. In January 2009 the Finance Committee, recommended that the Spring 2009 issue be electronic only, however the Executive Committee voted to go forward

with the printing of the Spring 2009 (vol 76) edition and to not mail it to international members.

- Mailing costs to members in the US are about approximately $3-4K per issue depending on the size and current postage rates. To control these costs, only the electronic version of the current volume of the PICOGRAM was available before the meeting; attendees can pick up a hard copy at the AGRO desk during the meeting. Non-attendees will be mailed a hard copy after the meeting.
- The Femtogram will be sent again following this meeting to remind members of the San Francisco and IUPAC meetings and to report the events of the Washington meeting.

MOTION: To reinstate the international mails for sending the PICOGRAMS. Motion passed.

IX. Website Update – Laura McConnell

- The division received $7300 from an ACS Innovative Grants proposal in August 2008 to develop our new web presence. The new website was initiated in approximately July 2008. It has been updated in January, May and July 2009. It currently highlights the call for papers for San Francisco.
- AGRO owns three domains: www.agrodiv.org, www.agrodiv.com, and www.agrodivision.org with costs paid through April, 2013. Skydev is providing web hosting services, helped us to create the website, implements updates upon request, and provides access to Google analytics data. Initial creation of the website was approximately $5200. We are charged monthly for hosting and hourly for updates. Recent traffic on the website was 735 visits from July 13 to Aug 12 primarily to information on the Washington meeting and awards. The majority of traffic was from search engines (60%) with 22% direct traffic and 17% from referring sites. We come up first on Google with the search Division of Agrochemicals, but we don't come up first when searching for agrochemicals (3rd page) or agro (5th page).

X. Membership Committee Report – Dan Stout & Chris Peterson

- The division, based on total numbers, has increased due mostly to a dramatic May 2009 where 170 new members were added. Analysis of the 170 increase might be useful to evaluate its success and future replication. The division is showing positive growth.
- Dan tried to convince the ACS to assemble this table for us, but they reportedly do not have the resources. Instead he requested they provide yearly, the monthly rosters, which they will do upon request. In the past we have discussed the origin of the tabulated numbers. He evaluated the full rosters for duplicates and found no inconsistencies in the monthly lists. Therefore, we can accept these numbers as absolute.

XI. Hospitality Committee Report - Jim Brady, Joe Massey, Julie Eble and Pat Rice

Pat reported that for:

- Philadelphia (Fall 2008) for Coffee Lounge $2,050 were collected from 10 companies.
- Washington, DC (Fall 2009) for Coffee Lounge, $2,500 were collected from 15 companies.
- AGRO Division Awards & Social takes place on Tuesday 6:00-8:00pm, at Renaissance Washington Hotel.

XII. Strategic Plan Committee Report – Laura McConnell

- A detailed report of the strategic planning committee activities are on page 58 and 59 of the PICOGRAM v. 77. Many of the initiatives envisioned in our 2008 strategic planning meeting have borne fruit and have been extremely successful.
- A new website has been initiated; program planning has expanded to include new venues; and this has increased the international reach of the division.
- The division membership has increased. The Washington meeting is the largest program that AGRO has ever held. The energy of this work should be recharged with a new strategic planning meeting in 2011 to establish a new three year plan.
- A potential location is one of the two ACS National meetings. Meeting just prior to the National Meeting may be a lower cost option than a standalone meeting since the officer's travel will already be covered.
- Proposal for New Strategic Planning Meeting in 2011 – Purpose will include:
  - Update Mission, Vision, and Goals
  - Recharge committees and bring in new participants
  - Develop new three year plan

  Location: Thurs/Friday or Fri/Sat prior to 241st or 242nd ACS National Meeting
  - Officer's travel already partially paid
  - May be able to obtain assistance from ACS
  - Could apply for innovative grants funding to help off-set costs

MOTION: Look into a new strategic meeting in 2011. Laura will place a proposal at the next Spring meeting in 2010. Motion passed.

XIII. National Meeting Programming: Washington DC – Ellen Arthur

- 23 Symposia
- 40 Sessions
- 280 Presentations (Include 46 Posters)
- General Papers – 2 oral & 7 posters
- AGRO sponsored one-day guest registrations: ~73 – all of which were either authors or co-authors of presentations

- 14 Graduate Student Travel Awards
- Key Events and their locations

XIV. National Meeting Programming: San Francisco – Ken Racke

- Ken presented AGRO 2010 Symposia Announcements and Call for Papers at the 239th ACS National Meeting & Exposition, March 21-25, 2010 San Francisco, CA
- .ACS Theme is: Chemistry for a Sustainable World.
- The Agrochemicals Division (AGRO) of the American Chemical Society is planning an exciting and diverse technical program in San Francisco, CA at the 2010 Spring National Meeting.
- We have four award symposia planned, including Sterling-Hendricks, AGRO International Research Award, New Investigator, and Graduate Student.
- There are fourteen additional symposia being planned at this point.
- A special symposium is being organized to honor Prof. John Casida, his students, and friends.
- There are several environmentally-related symposia that should have high interest on the West Coast including ones focused on mitigation practices for surface water quality, pesticides and urban water quality, contaminants in coastal and marine systems, and greenhouse gases.
- We also have symposia planned for invasive species, biotech, human exposure, chirality, efficient application practices, pesticide inerts, food safety, analytical advances, and biofuels.
- For each symposium, a 1-page announcement and call for papers was published in the recent Picogram. These 1-pagers are also available for use by organizers in recruiting speakers and publicizing the symposia.
- Please pass on any suggestions or suggestions you might have for making the San Francisco program a great success.
- Any further ideas or questions related to the San Francisco technical program can be directed to 2010 AGRO Program Chair Ken Racke at (317) 337-4654 or KRacke@dow.com.

XV. Multidisciplinary Program Planning Group (MPPG)& Update and Future Themes – Ellen Arthur

- Input sought from Divisions for possible themes for upcoming meetings
- Breakfast for Program Chairs Tuesday morning 7 to 9 am in 102B Convention Center to discuss Boston meeting and how Division programming might fit into theme.
- Themes for upcoming meetings:
  2010
  ✓ San Francisco
  – Chemistry for a Sustainable World
  ✓ Boston
  – Chemistry of Preventing and Combating Disease
  2011
  ✓ Anaheim
  – Chemistry of Natural Resources
  ✓ Denver
  – Chemistry of Air, Space, and Water
  2012
  ✓ San Diego
  – Chemistry of Life
  ✓ Philadelphia
  – Chemistry of Health
  2013
  ✓ New Orleans
  – Chemistry of Energy and Food (Suggested Chemistry of Natural Disasters)
  ✓ Indianapolis
  – Chemistry in Motion
- If you have ideas for possible meeting themes or sub-themes, please contact the 2009 MPPG Chair Michael Morello.

XVI. Perspectives on AGRO Programming at 1 National ACS Meeting a Year – Ken Racke

- One recommendation from the Division's Long-Range Strategic Planning Conference held in Washington, DC during January, 2006, was for AGRO to program only at the fall ACS national meeting each year. Based on this recommendation, AGRO decided to program at only one national meeting on a 3-year trial basis for 2008 (Fall – Phila.), 2009 (Fall - Wash-DC), and 2010 (Spring – San Fran.). The spring 2010 meeting in San Francisco was selected instead of the fall meeting due to perception of a more favorable venue. At this time, the AGRO Division needs to decide for 2011 and beyond whether to continue the practice of programming at one national meeting a year or revert to programming at both national meetings each year. Pro's and con's associated with programming at only one national meeting a year were discussed at the 2006 strategic planning conference, and seem to capture the primary areas of interest and concern. The bullets listed below summarize these considerations, along with a few comments and statistical comparisons regarding the actual experiences during the present trial period.

Pros

- Decreased competition with other meetings would improve focus and lead to greater impact and participation and a higher quality program – AGRO had two out of the top three meetings ever on a historical basis during 2008 and 2009 in terms of number of papers (see Figure 1).

- Increased member participation in the program of the annual AGRO national meeting – Probably inadequate data for conclusions, but overall oral symposia attendance in Phila. during the first single-meeting year (2008) exceeded recent individual meetings (see Table I).
- Reduced financial burden on members by avoiding travel to both national ACS meetings.
- Decreased competition allowing AGRO-sponsored special conferences to be more successful and increasing flexibility for new types of programming – 3rd Pan-Pac in 2008 was the most successful (236 attendees); AGRO programmed at SETAC during Nov-2008 and is planning to participate again in 2009; AGRO co-sponsored conferences in China (Oct-2007) and Brazil (Nov-2009); a solid Pacifichem plan is in place for Dec-2010.
- Allows officers, especially program chair, to invest time in one major AGRO event per year.

Cons

- Loss of participation of members based on school, vacation, or geographic limitations – Need to consider feedback from specific members.
- Loss of programming synergies with AGFD and ENVR – AGFD was willing to move the Sterling-Hendricks award to SF for 2010 to accommodate our selection of the spring meeting. May need to seek further feedback from AGFD and ENVR.
- Decline in total member participation in AGRO activities – The total number of papers presented at the national meeting(s) was below historic averages during 2008 and 2009 (see Figure 2). However, when papers presented at the AGRO-sponsored Pan Pacific Pesticide conference are considered (e.g., 206 during 2008) this deficiency is less evident.
- Reduced communication rate with members – Member survey may be needed. Important to consider the role of the AGRO website and member publications (Femtogram, PICOGRAM).
- Potential for differential officer terms if not annually programming at same time of year.

Other Perspectives

- Ann Lemley suggested that the option of 2 meetings per year can work if there is no conflict with regional meetings. If we continue with one meeting per year, the meeting location is driven by the city. Some cities are preferred over the others.
- Al Barefoot proposed continuation with one meeting per year, always in the Spring or Fall.
- Kevin opted for one AGRO full program per year (Spring or Fall) and one special program with another division so that we can get credit from ACS.

MOTION: Program for one meeting per year in 2011-2012. Motion Passed.

MOTION: Executive Committee approves changes to move the official Business Meeting to the annual meeting at which AGRO is programming.

MOTION: 2011 AGRO National Meeting is going to take place in Denver (Fall Meeting). Motion passed.

MOTION: 2012 AGRO National Meeting is going to take place in San Diego. (Spring Meeting). Motion defeated.

XVII. Graduate Student Training in Industry Opportunity – Glenn Miller

- The goal is to have graduate or undergraduate students spending time in a company ~3 months/year without a formal internship program. Also, to have agro groups with W1045 and make recommendations to advocate students and have the industry to offer this possibility.
- Some of the industry representatives talked about the need to have a confidentiality agreement in place with each of the students.

XVIII. Education Committee Report – John Johnston & Allan Felsot

New Investigator Award

- During 2009, three applications were received for the AGRO New Investigator Award. The subject areas of the applicants included environmental chemistry of pesticides and flavonoid inhibition of acrylamide formation. The 2009 winner was selected by a committee consisting of Allan Felsot, John Johnston, and Vince Hebert. The winner was Dr. Jennifer Anderson, currently at Iowa State University. The Award will be presented to Dr. Anderson at the Fall 2009 meeting in Washington DC. In addition, Dr. Anderson will be giving her presentation in the New Investigator Award Symposium. The Symposium will be held in conjunction with papers submitted under the theme of New Developments and Issues in Agrochemical Sciences. Other award applicants who will be speaking include Dr. Yu Zhang, a postdoctoral fellow at Massachusetts General Hospital and Harvard Medical School, and Dr. Laura Moreno-Delgado, a postdoctoral researcher at the Univ. of California-Riverside. The symposium will be held Sunday afternoon at the national meetings.
- The next call for New Investigator applicants has been published in the PICOGRAM. The competition is being held in conjunction with the ACS 2010 Spring Meeting in San Francisco. Applications are due to Allan Felsot by November 2, 2009.

- At this time, the current chair of the New Investigator Award is seeking a new person to take over leadership of the Award. Interested persons should contact Allan Felsot, Washington State University, afelsot@tricity.wsu.edu for more information.

Student Travel Grants

- AGRO is awarding travel grants ($840 – grant, registration, student ACS membership) to 14 students representing ten universities. Topics include pesticide chemistry, environmental chemistry, computational chemistry, molecular biology, worker safety, pesticide metabolism, pharmacokinetics, environmental fate and risk management. Please visit with the students during their poster presentations on Monday Morning and at Sci Mix (Monday Evening).

Goal 2: *Foster constructive interactions among diverse communities to provide solutions to agricultural, public health and environmental concerns.*

XIX. FPRW Report – Kevin Armbrust

The Florida Pesticide Residue Workshop July 2009 in St. Pete Beach Florida. There were 240 attendees, 46 papers over 3 days and 40 different vendors representing all of the major instrument manufactures and suppliers of analytical commodities. All attendees will be given complimentary 1 year memberships in AGRO to encourage future membership in the division. The meeting next year will be held July 18th to the 21st, 2010 in St. Pete Beach Florida and will be managed by ACS meetings. It will feature sessions on international opportunities for collaboration as well as chemical issues related to food safety.

XX. Pacifichem December 2010 – John Johnston

- Pacific Chem is scheduled in middle December 2010 in Honolulu
- Two main issues are going to be approached: safety impact and environmental impact in two symposia entitled "International Food Safety Issues and Opportunities" and "Rodenticide-Based Opportunities for protection of Agriculture, Eco-Systems and Public Health".

XXI. Future Special Conferences Committee Report

- Laura McConnell will confirm with Pesticides Society of Japan special conferences that AGRO can have with them in 2012.

Goal 3: *Build the infrastructure for becoming a global center for solutions to problems of plant, animal, environmental, and public health protection, and advancing scientific and regulatory harmonization.*

XXII. Latin American Workshop 2009 Update – Ken Racke

- 3rd International Workshop on Crop Protection Chemistry in Latin America: Environmental, Safety and Regulation, November 9-12, 2009 in Rio de Janeiro, Brazil.
- The topics are:
  1. Innovative Chemistry and Technology for Crop Protection.
  2. Risk Assessment Regulation and Global Harmonization.
  3. Environmental Chemistry and Risk Assessment.
  4. Pesticide Residues in Food.
  5. Education and Information Management in Crop Protection.

XXIII. IUPAC Pesticide Congress (Melbourne, 2014) Update – Laura McConnell

- 2011 is the International year of Chemistry and 100-yrs anniversary of Marie Curie Nobel Prize. ACS will announce an event in the website related to this anniversary.
- Suggested Topics are: Pesticide Risk Assessment, Pesticide Risk Mitigation, Pesticide Fate and Transport, Pesticide Use in Tropical Ecosystems, Pesticide Use in Developing Countries, Advances in Technologies - Updates and Environmental Impacts

XXIV. IUPAC 2014 potential proposal for San Francisco – Ken Racke

- Ken Racke will check with ACS the feasibility of a 2014 IUPAC Congress in conjunction with San Francisco National Meeting.

XXV. Miscellaneous

- All job postings Tim Ballard receives will be sent to the Chair who will approve their listing.
- If the person who will post the job is an AGRO member, no fee will be charged. Otherwise, the person/company will be charged for the service. The charge will be a source of revenue for the AGRO division.

Important Announcement

Barry Cross announced that in April 2009 Don Baker passed away. Don was an active member in the AGRO division for MANY years. He was a mentor for many of chemists and in Barry's opinion, Don had more patents than any other living chemists. Barry will write a short memo and Cathleen will place it into the next PICOGRAM.

Bylaws of the AGRO Division of the American Chemical Society *

** Effective October 27, 2000. Approved, as amended, by the Committee on Constitution and Bylaws, acting for the Council of the American Chemical Society.*

Bylaw I. Name and Objects

Section 1. The name of this organization shall be the Division of Agrochemicals (hereinafter referred to as "the Division") of the AMERICAN CHEMICAL SOCIETY (hereinafter referred to as "the SOCIETY").

Section 2. The objects of the Division shall be to bring together persons particularly interested in agrochemicals, to consider all scientific aspects of chemistry relevant to the control of pests of agricultural or public health significance and to other methods for enhancing or modifying agricultural productivity, to develop and improve the professional stature of chemists with these interests, and to render whatever service it may to the scientific and lay communities on the topic of agrochemicals.

Bylaw II. Members and Affiliates

Section 1. Membership in the Division shall be open to all members of the SOCIETY. Application for membership shall be made in writing to the Secretary of the Division and shall be accompanied by one year's dues.

Section 2. A National Affiliate of the SOCIETY may apply to the Secretary to become a National Affiliate of the Division. Provided that Division dues established for National Affiliates are paid, a National Affiliate shall have all the privileges of membership in the Division except those of voting for or holding an elective position of the Division, voting on articles of incorporation or bylaws of the Division, or serving as a voting member of its Executive Committee.

Section 3. The Division may accept Division Affiliates who are not members or National Affiliates of the SOCIETY but who wish to participate in the activities of the Division. Such affiliates shall be entitled to all the privileges of membership in the Division save those withheld by the Bylaws of the SOCIETY.

Section 4. Members may resign their membership in the Division by submitting their resignation, in writing, to the Secretary during the year for which their dues are paid.

Section 5. The name of any member of the Division who is in arrears in payment of dues by as much as two years shall be stricken from the rolls. A member dropped for nonpayment of dues may be reinstated upon payment of arrearages.

Section 6. Affiliates shall retain affiliate status only so long as payment is made of Division dues. An affiliate's name is to be stricken from the rolls as soon as the affiliate is in arrears in the payment of dues.

Section 7. The anniversary dates of Division members and National Affiliates of the Division shall coincide with their anniversary dates in the SOCIETY.

Bylaw III. Officers and Councilors

Section 1. The officers of the Division shall be a Chair, a Chair-Elect, a Vice-Chair, a Secretary, and a Treasurer. The Chair-Elect shall automatically succeed to the office of Chair upon expiration of the latter's term of office or if this office becomes vacant. The Vice-Chair shall automatically succeed to the office of Chair-Elect upon expiration of the latter's term of office or if this office becomes vacant. The offices of Secretary and of Treasurer may be held by one individual. Only MEMBERS are eligible to hold elective positions.

Section 2. The duties of the Chair shall be to preside at meetings of the Executive Committee, to carry into effect the decisions and recommendations of the Committee, to preside at stated meetings of the Division, and to appoint all committees except as otherwise provided.

Section 3. The duties of the Chair-Elect shall be to serve in the absence of the Chair of the Division and to act as Chair of the Program Committee.

Section 4. The duties of the Vice-Chair shall be to serve in the absence of the Chair-Elect and to act as Assistant Chair of the Program Committee, with particular emphasis on planning and developing technical programs.

Section 5. The duties of the Secretary shall be to keep minutes of all meetings of the Division and of the Executive Committee; to keep a roll of Division members and affiliates and to submit the same annually to the Executive Director of the SOCIETY for verification as provided in the Bylaws of the SOCIETY; to conduct the business correspondence of the Division as assigned to the Secretary by the Chair or by the Executive Committee; to prepare and submit an annual report of Division activities to the SOCIETY as required in the SOCIETY's Bylaws; to perform such other duties as may, from time to time, be assigned by the Chair or Executive Committee or required by the SOCIETY's Bylaws. The Secretary shall send to each member, at least two weeks before the regular meetings of the Division, abstracts of papers to be presented at said meetings.

Section 6. The Treasurer shall act as custodian of the funds of the Division, collect dues and other revenues, and pay the bills of the Division after the same have been authorized by the Executive Committee. The Treasurer shall maintain accurate records of receipts and disbursements and shall submit a report of the financial condition of the Division at the annual meeting of the Division. The Treasurer shall furnish a surety bond, the premium for which shall be paid from Division funds.

Section 7. Councilors and Alternate Councilors shall represent the Division on the Council of the SOCIETY as provided in the Constitution and Bylaws of the SOCIETY.

Section 8. The Division shall have an Executive Committee, which shall consist of the officers of the Division; the Immediate Past Chair of the Division; the Councilors and Alternate Councilors; the Chairs, Chairs-Elect, Vice-Chairs, and Immediate Past Chairs of Subdivisions, if any; and fifteen (15) Members-at-Large. The Chair of the Division shall serve as Chair of the Executive Committee.

Section 9. The officers of the Division other than the Chair and the Chair-Elect shall be elected by mail ballot as described elsewhere in these bylaws.

Section 10. At the annual meeting of the Division, the Executive Committee shall appoint a Nominating Committee consisting of at least three members, one of whom shall be the Immediate Past Chair of the Division, who shall serve as Chair of this Committee. This Committee shall nominate two candidates for the office of Vice-Chair and at least ten (10) candidates for the positions as Members-at-Large to be filled on the Executive Committee. This Committee shall nominate candidates for each of the following offices to be filled: Councilor, Alternate Councilor, Secretary, and Treasurer. This Committee shall submit a report in writing to the Chair of the Division for preparation of the ballot to be mailed to the membership. Additional nominations may be made in writing by any group of at least five members and presented to the Chair of the Division not less than three months prior to the fall meeting.

Section 11. Officers and Members-at-Large shall be elected by the members and Division Affiliates of the Division. Only members of the Division may vote for Councilors and Alternate Councilors. The Secretary or other designated officer of the Division shall prepare an election ballot, on which shall appear the names in order chosen by lot of all candidates nominated and found willing to serve. In all Division balloting conducted by mail, the ballot voted shall be sealed, without voter identification, in a special ballot envelope. The special ballot envelope, bearing no voter identification, shall be enclosed in a larger envelope upon which—or within which, on a separate slip—shall be hand-inscribed the name of the member voting; the larger envelope shall then be sealed and forwarded to the Chair of the Tellers Committee. The Tellers shall count the ballots thus received, using the list of members provided by the Secretary to verify the eligibility of all those voting. Any ballot envelope not validated by the voter's accompanying hand-inscribed name shall be rejected. The Secretary shall set and announce in advance of the neither balloting the interval during which ballots must be received to be counted; this interval shall not be less than four nor more than seven weeks following the ballot mailing. The Tellers Committee, appointed by the Chair of the Division, shall be responsible for counting all valid ballots received within the interval and shall certify the results to the Secretary, who shall in turn certify the results to the SOCIETY, the elected officials, and the Division. Elections are to be by plurality, should there be more than two candidates for an office. Resolution of a tie vote shall be made by the Executive Committee.

Section 12. The Chair, the Chair-Elect, the Vice-Chair, the Secretary, and the Treasurer of the Division shall serve for one year or until their successors are elected.

Section 13. The terms of office of the Members-at-Large of the Executive Committee shall be three years. Five Members-at-Large shall be elected each year.

Section 14. The terms of Councilors, Alternate Councilors, and all officers excluding the Chair, Chair-Elect, and Vice-Chair shall begin on January 1 following their election. The terms for Chair, Chair-Elect, and Vice-Chair shall begin at the conclusion of the fall meeting of the SOCIETY.

Section 15. Vacancies in offices other than Chair and Chair-Elect shall be filled by the Executive Committee. Incumbents so selected shall serve until the next regular election.

Bylaw IV. Councilors

The Division shall have Councilors and Alternate Councilors whose terms of office shall be three years. Alternate Councilors shall serve only for specific meetings of the Council when a Councilor is not able to attend.

Bylaw V. Committees

Section 1. There shall be a Program Committee, consisting of three or more members, one of whom shall be the Chair-Elect of the Division, who shall serve as Chair of the Committee. A second member of the Committee shall be the Vice-Chair. The Program Committee shall have the entire responsibility for organizing the program of papers for all Division meetings. It shall work cooperatively with other Divisions of the SOCIETY and other bodies in planning joint sessions and symposia of mutual and timely interest.

Section 2. There shall be a Membership Committee of three or more members. This Committee shall aggressively promote membership in the Division by members of the SOCIETY.

Section 3. There shall be a Finance Committee of two or more members. This Committee shall audit the accounts of the Treasurer prior to the business meeting of the Division and report its findings at the annual meeting. This Committee shall advise the Executive Committee on financial resources.

Section 4. There shall be an Awards Committee of at least six members. This Committee shall maintain and develop the Division and International Awards Programs.

Section 5. There shall be a Hospitality Committee of at least two members. This Committee shall direct social events in coordination with other committees and maintain a hospitality table at Division meetings.

Section 6. There shall be a Publication Committee of at least three members. This Committee shall be responsible for publication of the Division newsletter, PICOGRAM, and other Division publications.

Section 7. Special committees may be appointed to consider, conduct, and report upon such special matters as may be delegated to them.

Section 8. Except where otherwise provided, committee appointments shall be made by the Chair, with the advice and approval of the Executive Committee.

Bylaw VI. Dues

Section 1. Members of the Division shall pay annual dues, the exact amount to be decided by the Executive Committee. Dues are payable in advance. Members who have been granted emeritus status by the SOCIETY and who are interested in the work of the Division shall be granted all privileges of Division membership without the payment of annual dues.

Section 2. Affiliates shall pay annual dues of $2.00 more than members; except that Division Affiliates who are regularly matriculated students specializing in a chemical science shall pay annual dues of an amount to be decided by the Executive Committee.

Bylaw VII. Subdivisions

Section 1. Composition. The Division may sponsor Subdivisions devoted to specialized fields within the area of Division interest. Membership in the Division shall be a requirement for membership in a Subdivision.

Section 2. Formation. Formation or discontinuance of a Subdivision shall be at the discretion of the Executive Committee of the Division. Steps to initiate a Subdivision may be made by petition of a group of Division members to the Executive Committee or by the action of the Executive Committee. The scope of the activities of any Subdivision shall be defined by the Executive Committee.

Section 3. Officers. Upon approval of the formation of a Subdivision, the Executive Committee of the Division shall appoint a Chair, Chair-Elect, Vice-Chair, and Secretary for the Subdivision. The Chair-Elect shall assume the office of Chair after one year. In succeeding years the Subdivision shall elect at the annual meeting a Chair-Elect and a Secretary. The Chair, a Chair-Elect, and Secretary shall constitute a Steering Committee for the Subdivision. This Steering Committee shall report through the Chair of the Subdivision and be responsible to the Executive Committee of the Division, of which Subdivision Chairs shall be members ex officio.

Section 4. Funds. The necessary expenses for each Subdivision shall be authorized by the Executive Committee of the Division from Division funds and shall be paid by the Treasurer of the Davison upon the usual authentication.

Bylaw VIII. Meetings

Section 1. There shall be a meeting of the Division at each national meeting of the SOCIETY unless the Executive Committee votes otherwise, provided the requirements for a minimum number of meetings as specified in the SOCIETY Bylaws shall be met.

Section 2. The annual meeting of the Division shall be held at the fall meeting of the SOCIETY. Division business requiring vote of the membership shall be conducted only at this meeting, except as provided elsewhere in these bylaws. However, voting by the membership may be conducted by mail or as directed by the Executive Committee.

Section 3. Special meetings of the Division may be called by the Executive Committee, provided notice is given to the membership in writing or by publication in Chemical & Engineering News at least two months in advance. Special meetings may not be held within one month before or after a national meeting.

Section 4. Fifteen (15) members of the Division shall constitute a quorum for the conduct of business.

Section 5. The fee for registration at any special meeting shall be decided by the Executive Committee in accordance with the Bylaws of the SOCIETY.

Section 6. The rules of order in the conduct of Division meetings not specifically provided in these bylaws or in the SOCIETY's documents shall be the most recent edition of Robert's Rules of Order, Newly Revised.

Bylaw IX. Papers

Section 1. The Program Committee may approve or reject papers submitted for presentation before any meeting of the Division.

Section 2. The rules for papers presented before meetings of the SOCIETY as outlined in the Bylaws and Regulations of the SOCIETY shall govern the Division.

Bylaw X. Amendments

Section 1. These bylaws may be amended at any annual meeting of the Division by a two-thirds (2/3) vote of the members present. All amendments shall be submitted in writing to the Secretary at least sixty (60) days prior to the meeting. Upon approval of the Executive Committee, the Secretary shall send the text of the proposed amendment to the members of the Division at least thirty (30) days prior to the annual meeting.

Section 2. Amendments shall become effective upon approval by the Committee on Constitution and Bylaws, acting for the Council, unless a later date is specified.

Bylaw XI. Dissolution

Upon dissolution of the Division, any assets of the Division remaining thereafter shall be conveyed to such organization then existent as is dedicated to objects similar to those of the Division and the AMERICAN CHEMICAL SOCIETY, or to the AMERICAN CHEMICAL SOCIETY, so long as whichever organization is selected by the governing body of the Division at the time of dissolution shall be exempt under Section 501(c)(3) of the Internal Revenue Code of 1954 as amended or under such successor provision of the Code as may be in effect at the time of the Division's dissolution.

American Chemical Society
AGRO DIVISION
239th ACS National Meeting
March 21 – 25, 2010
San Francisco, California

K.D. Racke, *Program Chair* and E.L. Arthur, *Division Chair*

PROGRAM

AGRO POSTER SESSIONS & COFFEE
New Developments in Agrochemicals
Monday – Tuesday - Wednesday
9:30 AM – 4:00 PM
The Moscone Center – Room 3011 West Bldg

DIVISION BUSINESS
AGRO Business and Program Meeting
Sunday 5:00 PM
The Moscone Center – Room 3011 West Bldg

SOCIAL EVENTS
Sterling B. Hendricks Award Lecture Reception
Tuesday following the 11:30 AM lecture
The Moscone Center – Room 3016 West Bldg
AGRO Awards Social
Tuesday 6:00 – 8:00 PM
The Moscone Center – Room 2020 West Bldg
Members/Guests welcomed; see page 9
Graduate Student Luncheon
Wednesday 12:00 – 1:00 PM
The Moscone Center – Room 3005 West Bldg
Invitation only; see page 28
Blues & Brews – Program Planning Social
Wednesday 5:00 – 7:00 PM
The Moscone Center – Room 3009 West Bldg
All members welcomed; see page 37

SYMPOSIA OF INTEREST IN OTHER DIVISIONS
SUNDAY
Biochars for Environmental Sustainability: Green Fuels, Carbon Sequestration, and Long-Term Agricultural Production
Sponsored by ENVR
Parc55 – Sutro Room
8:30 AM – 12:25 PM

MONDAY
Atmospheric Chemistry of Persistent Organic Pollutants
Sponsored by ENVR
Parc55 – Stockton Room
8:30 – 11:40 AM

TUESDAY
Biocatalysis for Biofuels and Bioproducts Lignocellulosics
Sponsored by AGFD
Cosponsored by AGRO, CELL, and SUST
The Moscone Center – Room 3004 West Bldg
8:20 AM – 5:30 PM
Biogeochemistry of Endocrine Disrupting Chemicals in Natural Systems
Sponsored by see *GEOC*
Parc55 – Cyril Magnin III Room
8:30 – 11:00 AM
Organic Foods: Interpreting the Science and Understanding the Facts Related to Human Health – Agronomic Impacts
Sponsored by AGFD
Cosponsored by AGRO and SUST
The Moscone Center – Room 3000 West
1:30 – 4:30 PM

WEDNESDAY
Biocatalysis for Biofuels and Bioproducts Lignocellulosics
Sponsored by AGFD
Cosponsored by AGRO, CELL, and SUST
The Moscone Center – Room 3004 West Bldg
8:30 – 11:45 AM
Sustainability of Our Food Supply: From Farm to Fork
Sponsored by AGFD
Cosponsored by AGRO
The Moscone Center – Room 3004 West Bldg
1:30 – 3:55 PM

SUNDAY MORNING

Advances in the Discovery of New Agrochemicals
Cosponsored by AGFD
E. Hellmuth, *Organizer*
W. Barnette, *Presiding*
T. Stevenson, *Organizer, Pres*

Section A
The Moscone Center – Room 3001 West Bldg

Team Innovation Award Symposium
8:15 – Introduction

8:20 – 1. Award Address (ACS Award for Team Innovation Sponsored by the ACS Corporation Associates). Evolution of synthetic routes to N-pyridylpyrazole anthranilic diamide insecticides: The discovery of Rynaxypyr®. **T. M. Stevenson**, G. P. Lahm, T. P. Selby, J. H. Freudenberger, C. M. Dubas-Cordery, B. K. Smith, K. A. Hughes, D. Cordova, L. Flexner, C. A. Bellin

8:45 – 2. Award Address (ACS Award for Team Innovation Sponsored by the ACS Corporation Associates). Preparation of 3-halo-1-aryl-1H-pyrazole-5-carboxylic acids: The early process development of Ryanxypyr®. **J. H. Freudenberger**, G. D. Annis, P. J. Fagan

9:05 – 3. Award Address (ACS Award for Team Innovation Sponsored by the ACS Corporation Associates). Discovery of Cyazypyr™: A new anthranilic diamide ryanodine receptor activator for cross-spectrum insect control. **T. P. Selby**, G. P. Lahm, T. M. Stevenson, K. A. Hughes, I. B. Annan, D. Cordova, C. A. Bellin, E. A. Benner, K. D. Wing, J. D. Barry, M. J. Currie, T. F. Pahutski

9:30 – Intermission

Spencer Award Symposium
9:45 – Introduction

9:50 – 4. Discovery of aminocyclopyrachlor: How anthranilic diamide insecticides led to a new broad-spectrum auxinic herbicide. **B. L. Finkelstein**, G. Armel, S. Bolgunas, D. A. Clark, J. S. Claus, R. J. Crosswicks, W. Hong, C. M. Hirata, G. P. Lahm, T. P. Selby, T. M. Stevenson

10:15 – 5. Synthesis and biological activity of cyanoarylsulfonamides. **W. von Deyn**, F. Kaiser, M. Pohlman, D. Anspaugh

10:40 – 6. Cyclic ketoenols: Discovery and chemical evolution of a new generation of resistance-breaking insecticides and acaricides. R. Fischer, T. Bretschneider, **E.-R. F. Gesing**, R. Nauen

11:05 – 7. Spiroindolines: Discovery of a novel class of insecticides. **J. Cassayre**, D. J. Hughes, R. S. Roberts, P. A. Worthington, F. Cederbaum, P. Maienfisch, L.-P. Molleyres

11:30 – 8. Award Adress (Kansas City Section Spencer Award). Evolution of the diamide through isoxazoline insecticides. **G. P. Lahm**, J. K. Long, T. F. Pahutski, B. K. Smith, M. J. Mahaffey, J. R. Rauh, D. Cordova, R. M. Smith, J. D. Barry

Contemporary Food Safety Issues: Mitigating Risks from Production to Processing
Cosponsored by AGFD
R. Molyneux, *Organizer*
J. Seiber, *Organizer, Presiding*

Section B
The Moscone Center – Room 3003 West Bldg

9:00 – Introductory Remarks

9:05 – 9. Food safety on the farm: Movement toward the development of sustainable and environmentally compatible pre-harvest interventions for livestock producers. **R. C. Anderson**, D. J. Smith, N. A. Krueger, R. C. Beier, T. R. Callaway, T. S. Edrington, R. B. Harvey, D. J. Nisbet

9:25 – 10. Non-pheromonal control of navel orangeworm as a promising method toward decreasing contamination of *Aspergillus flavus* in California tree nuts. **J. J. Beck**, D. M. Light, B. S. Higbee, K. Dragull, G. B. Merrill, W. S. Gee

9:45 – 11. Review of antimicrobial activities of plant-derived edible compounds against susceptible and antibiotic-resistant foodborne pathogens. **M. Friedman**, C. E. Levin

10:05 – Intermission

10:20 – 12. Rapid identification of protein biomarkers and toxins from food-borne pathogens by top-down proteomics. **C. K. Fagerquist**

10:40 – 13. Effects of gamma and ultraviolent radiation on furan formation. **X. Fan**

11:00 – 14. Antimicrobial packaging: Additional intervention technology for food safety. **T. Z. Jin**

Invasive Species: Is Chemistry up to the Task?
E. L. Arthur, S. O'Toole and K. Racke, *Organizers*
T. Ellis, *Organizer, Presiding*

Section C
The Moscone Center – Room 3005 West Bldg

8:30 – Introductory Remarks

8:35 – 15. Response to invasives: The good, the bad, and new chemistries are needed. **T. A. Batkin**

9:00 – 16. National perspective of the detection of and response to exotic pests. **S. O'Toole**, O. El-Lissy

9:25 – 17. Regulation of invasive species in California. **R. Leavitt**

9:50 – Intermission

10:00 – 18. Detection of Huanglongbing in Florida citrus: Rapid responses and tapping the global knowledge base. **J. W. Bell**, D. Rogers, R. F. Morris II, R. D. Bagwell, L. S. Hall, E. G. Ishida

10:25 – 19. Development and use of green chemistry insecticides and novel delivery systems for area wide control programs of invasive insects. **L. E. Gomez**, B. Bisabri, B. Bret, D. L. Paroonagian

10:50 – 20. Pesticides and the federal imported fire ant quarantine. **C. L. Brown**, A.-M. Callcott

11:15 – 21. A chemical history of gypsy moth management in North America. **D. R. Lance**

11:40 – Concluding Remarks

Understanding Greenhouse Gases from Agriculture
Cosponsored by AGFD
L. Guo and L. McConnell, *Organizers*
A. Gunasekara and S. Pittiglio, *Organizers, Presiding*

Section D
The Moscone Center – Room 3007 West Bldg

8:20 – 22. Collaborative research efforts in determining N_2O emissions from agricultural soils in California. **L. Guo**, D. Luo, M. FitzGibbon, G. Franco, S. Pittiglio, A. Gunasekara

8:40 – 23. Nitrous oxide emissions in response to nitrogen fertilization in lettuce production systems. **M. Burger**, T. Bottoms, R. Smith

9:00 – 24. Climate impacts from agricultural emissions: Greenhouse species and aerosols. **J. S. Gaffney**, N. A. Marley

9:20 – 25. Exchange fluxes of NO_x, N_2O, and NH_3 between two typical Chinese agricultural fields and the atmosphere. **Y. Mu**

9:40 – 26. Challenges for developing GHG inventories for California crops: A case study of rice production. **A. Kendall**, S. Brodt, G. Feenstra

10:00 – Intermission

10:15 – 27. Large decline in fertilizer-induced direct N_2O emission estimates from Chinese intensive agriculture by minimizing both errors and nitrification of NH_4^+-based fertilizer. **X. Ju**, X. Lu, F. Su, F. Zhang

10:35 – 28. Alternative rice flood management effects on methane and nitrous oxide emission. Y. Assa, **W. R. Horwath**

10:55 – 29. Withdrawn

11:15 – 30. Role of micro-irrigation systems on greenhouse gas emissions from California perennial crops systems. **D. R. Smart**, A. Kristensen, M. Matiesek, E. Suddick, R. B. Boulton, K. M. Scow

11:35 – 31. Volatile organic compound analysis of vermicompost from pachyderm manure by GC-MS. **Y. M. Astacio-Roman**, L. Martinez-Valentin, A. J. Pena-Quevedo

SUNDAY AFTERNOON

Increasing the Utility of Terrestrial Field Dissipation Data
A. Barefoot, *Organizer, Presiding*

Section A
The Moscone Center – Room 3001 West Bldg

1:30 – Introductory Remarks

1:35 – 32. OECD harmonization of terrestrial field dissipation guidline and ecoregion crosswalk. **M. Shamim**, M. Ruhman, F. Khan

2:00 – 33. Comparison of European field soil dissipation studies to NAFTA and international use environments: Soil and climatic conditions. **N. J. Snyder**, A. C. Barefoot, K. Malekani, J. J. Amos

2:25 – 34. Terrestrial field dissipation (TFD) study design and utility of data for California conditions. **J. Troiano**, M. Clayton

2:50 – Intermission

3:05 – 35. Results from terrestrial field dissipation studies conducted according to harmonized NAFTA guidance. **M. Ruhman**, M. Shamim

3:30 – 36. Comparison of European field dissipation studies to NAFTA and international use environments: Study design and dissipation rate data. **K. Malekani**, N. J. Snyder, A. C. Barefoot, M. White

3:55 – 37. Utilization of registrant-supplied data for probabilistic modeling of pesticide movement to California ground water. **M. Clayton**, J. Troiano

4:20 – 38. Screening approaches for predicting pesticide concentrations in groundwater. **D. Mao**, W. M. Williams, J. M. Cheplick, R. Morris

Contemporary Food Safety Issues: Mitigating Risks from Production to Processing
Cosponsored by AGFD
J. Seiber, *Organizer*
R. Molyneux, *Organizer, Presiding*

Section B
The Moscone Center – Room 3003 West Bldg

1:30 – 39. Infrared heating as a pasteurization method for almonds. **Z. Pan**

1:50 – 40. Detecting prions: Discriminating isoforms in the attomole range. **C. J. Silva**, B. C. Onisko, I. Dynin, M. L. Erickson, J. M. Carter

2:10 – 41. Review of anticarcinogenic and anticholesterol effects of the tomato glycoalkaloid tomatine. **M. Friedman**, C. E. Levin

2:30 – Intermission

2:45 – 42. Mitigating risks of foodborne pathogens by processing intervention technologies. **H. Q. Zhang**

3:05 – 43. FDA applications of field portable XRF for consumer product analysis: Cl to U down to low ppm levels in 60 seconds or less. **P. T. Palmer**, **H. Gregory**, P. E. Baker, R. Jacobs

3:25 – Panel Discussion

Invasive Species: Is Chemistry up to the Task?
E. L. Arthur, T. Ellis and K. Racke, *Organizers*
S. O'Toole, *Organizer, Presiding*

Section C
The Moscone Center – Room 3005 West Bldg

1:25 – Introductory Remarks

1:30 – 44. Status and future of herbicide use for controlling invasive aquatic plants. **K. D. Getsinger**

1:50 – 45. Working within the U.S. regulatory framework to address invasive vertebrate pest issues. **J. D. Eisemann**, G. W. Witmer

2:10 – 46. Chemical management for controlling invasive frogs in Hawaii. **R. E. Doratt**, W. C. Pitt

2:30 – Intermission

2:40 – 47. Available US EPA tools to address invasive pests. **M. Laws**

3:00 – 48. Current use and future needs of semiochemical lures for California's detection and control programs. **K. M. Hoffman**

3:20 – 49. Minor significance or major problem?. **D. Kellum**

3:40 – Audience Q&A and Panel Discussion

4:10 – Concluding Remarks

Understanding Greenhouse Gases from Agriculture
Cosponsored by AGFD
A. Gunasekara, L. Mc Connell, and S. Pittiglio, *Organizers*
L. Guo, *Organizer, Presiding*

Section D
The Moscone Center – Room 3007 West Bldg

1:20 – 50. Questioning assumptions regarding soil nitrous oxide emissions and fertilizer use. **R. L. Phillips**

1:40 – 51. Nitrogen source effects on nitrous oxide emissions from irrigated cropping systems. **S. J. Del Grosso**, A. D. Halvorson

2:00 – 52. Urea fertilizer decreases N_2O emissions by 50% compared with anhydrous ammonia in corn/soybean cropping systems in Minnesota. **R. T. Venterea**

2:20 – 53. Greenhouse gas emissions in conventional and alternative cropping systems of California's Central Valley. **J. Six**

2:40 – 54. Process based models for quantifying nitrous oxide emissions: Calibration, validation and application of DNDC model in California cropping systems. **W. A. Salas**, C. Li

3:00 – Intermission

3:15 – 55. Soil nitrogen cycling and GHG accounting methodologies. **S. Del Grosso**

3:35 – 56. COMET-VR: Decision support system for agricultural greenhouse gas accounting. **K. Paustian**, S. Ogle, R. Conant, M. Easter, J. Alvaro-Fuentes, G. Johnson, M. Merwin, C. Olson, J. Schuler, A. Swan, S. Williams, R. Vining

3:55 – 57. Role of nutrient management in reduction of greenhouse gases. **R. L. Mikkelsen**, C. S. Snyder

4:15 – 58. Carbon footprints and turf management: Carbon emissions and sequestration for golf courses. **S. Z. Cohen**, N. L. Barnes, A. Harding, K. Ingram

MONDAY MORNING

AGRO Poster Session & Coffee
Section E
The Moscone Center – Room 3011 West Bldg
9:30 AM – 4:00 PM
91 – 115. See subsequent listings.

International Award for Research in Agrochemicals

Strategic Molecular Designs of Neonicotinoid Insecticides. Symposium in Honor of Dr. Shinzo Kagabu

Financially supported by
BASF Corp. and DuPont Crop Protection
J. Casida and M. Tomizawa, *Organizers, Presiding*

Section A
The Moscone Center – Room 3001 West Bldg

Part I: Discovery of Neonicotinoids
8:00 – Symposium welcome and introduction of the keynote speaker and general background of the field. **J. Casida, M. Tomizawa**

8:10 – 59. Award Address. Discovery of imidacloprid and afterward development: View from strategic molecular design. **S. Kagabu**

8:40 – 60. Overview on the status and global strategy for neonicotinoids. **P. Jeschke**, M. Schindler, A. Elbert

Part II: Physicochemistry, metabolism, and resistance
9:10 – Introductory remarks. **K. Tanaka**

9:20 – 61. Importance of physicochemical properties for design of new pesticides. **M. Akamatsu**

9:50 – Intermission

10:10 – 62. Distribution and development of neonicotinoid resistance. **I. Denholm**, S. Foster, K. Gorman

10:40 – 63. Neonicotinoid metabolism in insects relative to mechanism-based resistance. **R. Nauen**

11:10 – 64. Neonicotinoid metabolism: Compounds, substituents, enzymes, and relevance. **J. E. Casida**

Pesticide Mitigation Strategies for Surface Water Quality
B. Bret, K. Goh and T. Potter, *Organizers, Presiding*

Section B
The Moscone Center– Room 3003 West Bldg

8:30 – Introductory Remarks

8:40 – 65. Challenges of creating a change continuum in the agricultural community: From resistance to adoption of environmental mitigations on the Central Coast of California. **K. Mercer**, C. Silvers, T. Roberts

9:00 – 66. Relating agrochemical fate with conservation practices in the Choptank River watershed. **C. J. Hapeman**, W. D. Hively, L. L. McConnell, C. P. Rice, G. W. McCarty, E. Codling

9:20 – 67. National stewardship program to mitigate carbamate pesticide risk in drinking water. **W. M. Williams**, B. A. Engel, R. Fawcett, G. Hoogeweg, J. M. Cheplick

9:40 – 68. Comparison of approaches for mitigating off-site transport of sediment-associated pesticides. **D. P. Weston**

10:00 – Intermission

10:20 – 69. Estimating pesticide retention efficacy for edge of field buffers using the Riparian Ecosystem Management Model (REMM) in southern Atlantic Coastal Plain landscapes. **T. L. Potter**, R. Williams, R. R. Lowrance

10:40 – 70. Comparison of models for estimating the removal of pesticides by vegetative buffer strips. **M. F. Winchell**, R. L. Jones, T. L. Estes

11:00 – 71. Vegetative filter strip efficacy study: Design, conduct, and simulation modeling of field data. **R. Everich**, A. C. Newcombe, M. Nett, T. Estes

11:20 – 72. Review of vegetated buffers and a meta-analysis of their mitigation efficacy in reducing nonpoint source pollution. **X. Zhang**, M. Zhang, X. Liu, R. A. Dahlgren, M. Eitzel

11:40 – 73. Modeling the effectiveness of mitigation measures on the diazinon labels. **N. J. Snyder**, W. M. Williams, D. L. Denton, J. Troyan

The Push for Greener Formulations: Evolving Regulatory Frameworks for Inerts and Co-formulants
New Challenges in Formulation Regulation for Agrochemicals
Financially supported by Joint Inerts Task Force
J. Yowell, *Organizer*
C. Cleveland, *Organizer, Presiding*

Section C
The Moscone Center – Room 3005 West Bldg

8:20 – Introductory Remarks

8:25 – 74. Reassessment of tolerances of inert ingredients under FQPA. **P. V. Shah**

8:45 – 75. The Joint Inerts Task Force (JITF), an effective task force model. **J. Messina**, A. J. Duggan

9:10 – 76. New paradigm for inert risk assessments. D. Davis, C. Olinger, **M. Lloyd**, M. Metzger

9:45 – 77. Overview of risk assessment results for the JITF inert ingredient clusters. **J. Johnston**

10:05 – 78. Applying cluster analysis to pesticide inert tolerance reassessment. **A. J. Duggan**

10:25 – Intermission

10:40 – 79. Global "Reach" of recent EU legislation and raw material issues for agrichemical formulation trends. J. Dawson, A. M. Fowles, **C. B. Cleveland**

11:05 – 80. Impact of coformulant regulation on pesticide formulations. **K. Swayze**, R. Boucher

11:35 – 81. Utilizing solvent blends to maximize green characteristics of emulsifiable concentrate formulations. **J. M. Gould-Boeder**, A. D. Malec, T. M. Figley

12:00 – 82. Use of yeast proteins to affect the function of surfactants and their application in agricultural formulations. **A. D. Malec**, M. G. Goldfeld, A. Michalow, **C. W. Podella**, J. W. Baldridge

12:25 – Concluding Remarks

Understanding Greenhouse Gases from Agriculture
Cosponsored by AGFD
A. Gunasekara, L. Guo, and S. Pittiglio, *Organizers*
L. Mc Connell, *Organizer, Presiding*

Section D
The Moscone Center – Room 3007 West Bldg

9:00 – 83. Clearing the air: Livestock's contribution to climate change. **F. M. Mitloehner**, M. Pitesky, K. Stackhouse

9:20 – 84. Emissions from Holstein and black Angus-cross feedlot steers and calves. K. R. Stackhouse, **M. S. Calvo**, Y. Pan, Y. Zhao, F. M. Mitloehner

9:40 – 85. Effects of dietary monensin on greenhouse gases from lactating dairy cows and waste. **S. E. Place**, S. W. Hamilton, E. J. DePeters, J. A. McGarvey, J. Lathrop, F. M. Mitloehner

10:00 – 86. Effects of biotechnology on greenhouse gases in feedlot cattle. **K. R. Stackhouse**, S. E. Place, M. S. Calvo, Y. Pan, Y. Zhao, F. M. Mitloehner

10:20 – 87. Effects of birdsfoot trefoil on nitrogenous gases from dairy cows and manure. **Q. Wang**, F. M. Mitloehner

10:40 – Intermission

10:55 – 88. Improved productivity reduces greenhouse gas emissions from animal agriculture. **J. L. Capper**

11:15 – 89. Biofuel GHG emissions from indirect land use change (iLUC): Surveying the model landscape. **J. Witcover**

11:35 – 90. Measurement of methane and nitrous oxide emissions from broiler houses in California. **R. Zhang**, X. Lin, E. Cortus, S. Jiang, A. Heber

AGRO Division Monday Poster Session & Coffee

New Developments in Agrochemicals
A. Gunasekara, C. Hapeman, J. Johnston and D. Stout, *Organizers*
K. Racke, *Organizer, Presiding*

9:30 AM – 4:00 PM
Authors Present 9:45 – 10:45 AM
and 2:45 – 3:45 PM

Section E
The Moscone Center – Room 3011 West Bldg

General Topics

91. Preliminary studies on fungal inhibition in stored swine feed treated with the Brazilian *Chenopodium ambrosioides* L. essential oil. **G. N. Jham**, C. M. Jardim, O. D. Dhingra, M. M. Freire

92. Herbicidal activity of sorgoleone analogs. **C. S. Mizuno**, A. M. Rimando, S. O. Duke

93. Natural furoquinoline alkaloids as photosynthetic inhibitors in spinach chloroplasts. **T. A. M. Veiga**, M. F. D. G. da Silva, B. King-Diaz, B. Lotina-Hennsen

94. Alkynylation of aryl aldehydes using alkynylboron dihalides. **M. Quinn**, M. L. Yao, G. W. Kabalka

95. Pyridostigmine bromide interferes with the inhibition of AChE by agricultural chemicals. J. Henderson, G. Glucksman, B. Leung, A. Tigyi, E. DePeters, **B. Wilson**

96. Analysis of phytotoxic fungal toxins from *Ascochyta caulina* liquid culture. **A. M. Rimando**, M. Fiore, A. Evidente

97. Determination of albendazole and its metabolites in the muscle tissue of yellow perch using liquid chromatography with fluorescence detection. **D. Yu**, N. G. Rummel, B. Shaikh

98. Phenotypic plasticity of disease-vectoring mosquitoes towards non-chemical and chemical stressor interactions. **L. L. Caldemeyer**, **A. D. DeRoussel**, T. D. Anderson

99. Chronic and acute dietary risk assessments based on simulated residue data. **C. Chen**, B. P. Smyser, A. B. Orth, J. E. Eble

100. Thiencarbazone-methyl: A new molecule for pre- and post-emergence weed control in corn. **E. R. F. Gesing**

101. Screening and isolating phytochemicals in Eastern Redcedar (*Juniperus virginiana*) for developing potential entrepreneurial opportunities. **C.-H. Lin**, B. M. Thompson, H.-Y. Hsieh, R. N. Lerch, M. A. Gold, H. E. Garrett, R. J. Kremer

102. Establishment of quantitative sequencing and residual filter contact vial bioassays for the monitoring of pyrethroid resistance in the common bed bug, *Cimex lectularius* L.. **K. M. Seong**, S. H. Lee, J. M. Clark, K. S. Yoon, D. Y. Lee, D. H. Kwon, T. A. Klein, H. C. Kim

103. Synthesis of 1-octen-3-ol analogs as mosquito attractants. **C. A. Layode**, E. Onyeozili, C. O. Ikediobi, L. M. Latinwo, J. E. Cilek

104. Composition of forage and grain from second generation insect-protected corn, Mon 89034, and its combined trait products are equivalent to that of conventional corn (*Zea mays* L.). **S. M. Drury**, W. P. Ridley

105. Natural product based chromenes as a novel class of potential termiticide. **K. M. Meepagala**, W. Osbrink, C. Burandt, A. R. Lax

Advances in Biofuels and Bioproducts: Life Cycle Analysis and Sustainability

106. Spatially explicit life cycle emissions from biofuel derived from wood biomass. **P. Tittmann**, S. Yeh

107. Synthesis and characterization of fatty acid methyl esters from waste trap grease using heterogeneous acid catalysts. H. L. Ngo, **H. Vanselous**, W. Lin

108. Effect of water on base-catalyzed transesterification of soybean oil with methanol over promoted hydrotalcite catalysts. **A. Coker**, A. Iretski, M. White, R. Hernandez, T. French

109. Discovery and characterization of hemicellulose-degrading enzymes. **C. C. Lee**, R. E. Kibblewhite, K. Wagschal, D. W. S. Wong, W. J. Orts

110. Energy saving processes for several basic chemical stuffs from biomass and carbon dioxide. **L. Liu**, J. Du

Pesticides in Urban Settings and Aggregate Human Exposures

111. Predictors of current-use urinary pesticide metabolite levels among pregnant women in the CHAMACOS cohort. **R. Castorina**, A. Bradman, M. E. Harnly, L. Fenster, D. B. Barr, R. Bravo, T. E. McKone, E. A. Eisen, B. Eskenazi

112. Instructions on household pesticide labels: Comparison with agricultural pesticide labels. **L. M. Hall**

113. Estimation of exposure of persons in California to the pesticide products that contain methomyl. **M. E. Stefanova-Wilbur**, J. P. Frank

Understanding Greenhouse Gases from Agriculture

114. N_2O fluxes from winter wheat and cabbage field in the North China Plain. **F. Su**, X. Hu, B. Huang, X. Ju, F. Zhang

115. Spatial apportionment of N_2O emission sources from California agricultural soils using process-based biogeochemical modeling. **L. Guo**, D. Luo, L. Li, M. Vayssieres, C. Li

MONDAY AFTERNOON

AGRO Poster Session & Coffee
Section E
The Moscone Center – Room 3011 West Bldg
9:30 – 4:00
Papers 91 – 115. See previous listings.

International Award for Research in Agrochemicals: Strategic Molecular Designs of Neonicotinoid Insecticides. Symposium in Honor of Dr. Shinzo Kagabu
Financially supported by
DuPont Crop Protection and BASF Corp.
J. Casida and M. Tomizawa, *Organizers, Presiding*

Section A
The Moscone Center – Room 3001 West Bldg

Part III: Neonicotinoid Chemistry
1:00 – Introductory Remarks. **T. Haga**

1:10 – 116. Chemistry of clothianidin and related compounds. **H. Uneme**

1:40 – 117. Molecular design and chemical properties of dinotefuran. **T. Wakita**

2:10 – 118. *cis*-Configuration: A new tactics/rationale for neonicotinoids molecular design. **Z. Li**, **X. Shao**, X. Qian, X. Xu

2:40 – 119. Discovery, biology and biochemistry of sulfoxaflor: A new sap-feeding insecticide. **M. R. Loso**, T. C. Sparks, J. Babcock, I. Denholm, B. C. Gerwick, K. Gorman, V. B. Hegde, J. X. Huang, D. Kelley, B. M. Nugent, J. M. Renga, R. B. Rogers, J. Thomas, G. B. Watson, Y. Zhu

3:10 – Intermission

Part IV: Nicotinic Receptor and Ligand Design
3:30 – Introductory Remarks. **D. Sattelle**

3:40 – 120. Chemical neurobiology of the nicotinic receptor. **D. Dougherty**

4:10 – 121. Analysis of structure and species selectivity of neonicotinoid insecticides using the acetylcholine binding protein as a structural template. **P. Taylor**, T. T. Talley, M. Harel, M. Tomizawa, J. E. Casida

4:40 – 122. Pharmacological characterization of insect nicotinic acetylcholine receptors. **N. S. Millar**

5:10 – 123. Receptor structure-guided neonicotinoid design. **M. Tomizawa**

Pesticide Mitigation Strategies for Surface Water Quality
T. Potter *Organizer*
K. Goh and B. Brett, *Organizers, Presiding*

Section B
The Moscone Center – Room 3003 West Bldg

1:30 – 124. From vegetated ditches to rice fields: Thinking outside the box for pesticide mitigation. **M. T. Moore**, R. Kroger, M. A. Locke, C. M. Cooper, J. L. Farris, E. R. Bennett, D. L. Denton

1:50 – 125. Tools to estimate necessary vegetated ditch BMPs for pesticide mitigation at a watershed scale. **M. R. Rogers**

2:10 – 126. Effect of riparian vegetation on surface water loading of ground and aerially-applied pesticides in cherry production. **J. J. Jenkins**, K. Wallis, P. Janney, H. Riedl

2:30 – 127. Constructed wetlands as a mitigation measure to reduce pesticide loads in agricultural tailwater. **R. L. Budd**, K. Goh, T. O'Geen, J. Gan

2:50 – Intermission

3:10 – 128. Efficacy of settlement ponds for reducing pyrethroid runoff in almond orchards. **J. C. Markle**, T. L. Prichard, T. E. Taliaferro, P. Klassen

3:30 – 129. Sediment ponds as a management practice to reduce pesticide runoff in almonds. **S. Gill**, F. C. Spurlock, J. Mullane

3:50 – 130. Management practices for reducing discharge of pyrethroids and sediment in irrigation drainage water. **R. L. Jones**, J. C. Markle

4:10 – 131. Effectiveness of pesticide removal using on-farm vegetated treatment systems and Landguard-op-a. **B. Anderson**, B. Phillips, J. Hunt, C. Siegler, J. Voorhees, R. Tjeerdema, B. Largay, P. Robins, R. Shihadeh, R. Antinetti

4:30 – 132. Evaluation of mitigation practices for reducing chlorpyrifos in irrigation run-off from vegetable fields. **M. D. Cahn**, B. F. Farrara

The Push for Greener Formulations: Evolving Regulatory Frameworks for Inerts and Co-formulants
VOC and Ozone Impacts: Experiments, Predictions and Regulation
Financially supported by Joint Inerts Task Force
J. Yowell, *Organizer*
C. Cleveland, *Organizer and Presiding*

Section C
The Moscone Center – Room 3005 West Bldg

1:30 – Introductory Remarks

1:35 – 133. Estimating pesticide product volatile organic compound emission speciation based on product composition. **D. R. Oros**, F. Spurlock

2:00 – 134. Pesticide solvents: Ozone formation potential and regional implications. **P. G. Green**, A. Kumar, C. Howard, M. J. Kleeman

2:20 – 135. Pesticide solvents: VOC sampling, analysis and ozone formation. **A. Kumar**, P. G. Green, C. Howard, M. J. Kleeman

2:40 – Intermission

2:50 – 136. Comparison of experimental and computation data for ozone production in California's San Joaquin Valley using updated agricultural emissions profiles. **C. J. Howard**, M. Kleeman, C. J. Hapeman

3:15 – 137. Volatile organic compounds in pesticide formulations: Analysis of volatility and potential contributions to ozone pollution. M. Zenali, C. J. Hapeman, A. Nguyen, **L. L. McConnell**

3:40 – Concluding Remarks

AGRO New Investigator Award
Financially supported by Dow AgroSciences
A. Felsot, *Organizer,*
E. Arthur and K. Racke, *Presiding*

Section C
The Moscone Center – Room 3005 West Bldg

4:00 – Introductory Remarks

4:10 – 138. Action of the pyrethroid insecticide decyanoazidofenvalerate on rat $Na_v1.8$ sodium channel expressed in *Xenopus* oocytes. **K. S. Yoon**, S. H. Lee, J. M. Clark

4:35 – 139. Insecticide susceptibility, acetylcholinesterase sensitivity and levels of detoxifying enzymes in field populations of the Asian citrus psyllid, *Diaphorina citri* Kuwayama. **D. R. Boina**, M. E. Rogers, L. L. Stelinski

Advances in Biofuels and Bioproducts: Life Cycle Analysis and Sustainability
Cosponsored by AGFD and CELL
J. Seiber, *Organizer*
C. Hapeman, *Organizer, Presiding*

Section D
The Moscone Center – Room 3007 West Bldg

1:30 – Introductory Remarks

1:35 – 140. Bioenergy from agriculturally derived solid wastes: Strategies to go beyond corn-derived ethanol. **W. J. Orts**, K. M. Holtman, D. Franqui-Espiet, D. V. Bozzi, R. D. Offeman

2:15 – 141. Implementing performance-based sustainability requirements for the low carbon fuel standard: Key design elements and policy considerations. **S. Yeh**, D. Sumner, S. Kaffka, J. Ogden, B. Jenkins

2:35 – 142. Lifecycle water consumption of future transportation fuels: Electricity vs. biofuels. **S. Yeh**, **G. S. Mishra**

2:55 – Intermission

3:10 – 143. Sustainable biofuels: Addressing life-cycle costs, benefits, and impacts. **T. McKone**, A. Horvath, P. Berck, M. Torn, M. Bomberg, A. Barrett, C. Scown, B. Strogen, C. Almirall

3:30 – 144. Fast pyrolysis of guayule biomass. **C. McMahan**, A. A. Boateng, K. Cornish

3:50 – 145. Rice straw utilization studies for biofuels production. **D. Franqui-Villanueva**, K. M. Holtman, D. V. Bozzi, F. D. Corpuz, W. J. Orts

4:10 – 146. Large-scale advanced biofuel implementation: A case study of Illinois and Indiana. **A. Horvath**, E. Masanet, T. McKone, A. Lobscheid, U. Mishra, K. Fingerman, T. Lipman, M. Auffhammer

MONDAY EVENING

Sci-Mix
K. Racke, *Organizer*
J. Johnston, *Organizer, Presiding*

Section E
The Moscone Center – Hall D

8:00 - 10:00 PM
92, 94, **103, 108.** See previous listings.
172, 173, 175, 176, 177, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 197, 269, 283. See subsequent listings.

TUESDAY MORNING

AGRO Poster Session & Coffee
Section E
The Moscone Center – Room 3011 West Bldg
9:30 AM – 4:00 PM
Papers 172 – 198. See subsequent listings.

Comparing Conventional and Biotechnology-Based Pest Management
Herbicides and Herbicide-Tolerant Crops
Financially supported by CropLife International
K. Carstens, W. Ridley and N. Storer, *Organizers*
S. Duke, *Organizer, Presiding*

Section A
The Moscone Center – Room 3001 West Bldg

9:00 – 147. Glyphosate-resistant weeds in glyphosate-resistant crops vs. non-glyphosate-resistant crops. **I. Heap**

9:25 – 148. Mechanism of resistance of evolved glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*). **T. Gaines**

9:50 – 149. Herbicide resistances in waterhemp (*Amaranthus tuberculatus*): A call for new options. **P. J. Tranel**

10:15 – Intermission

10:35 – 150. Glyphosate metabolism in glyphosate-resistant crops and weeds vs. susceptible crops and weeds. **S. O. Duke**, A. M. Rimando, K. N. Reddy, V. K. Nandula

11:00 –151. Environmental impacts of transgenic glyphosate-resistant soybean cultivation in Brazil. **A. L. Cerdeira**, D. L. Gazziero, S. O. Duke

11:25 – 152. Gene flow: It's not just for transgenes. **C. Mallory-Smith**

Pesticide Mitigation Strategies for Surface Water Quality
T. Potter, *Organizer*
B. Bret and K. Goh, *Organizers, Presiding*

Section B
The Moscone Center – Room 3003 West Bldg

8:30 – 153. Use of environmental fate processes to mitigate pesticide impacts on urban water quality. **R. S. Tjeerdema**, T. W. Jabusch

8:50 – 154. Comparison of agricultural run-off between organic farming and conventional chemical farming. **N. David**, F. Thomas

9:10 – 155. Targeting adoption of BMPs to farmlands adjacent to impaired waterways using GIS mapping and grower visits. **P. N. Klassen**

9:30 – 156. Testing the effectiveness of the dormant spray regulations, the diazinon dormant spray label restrictions, and current and future technical advances to reduce diazinon surface water runoff. **R. C. Ehn**

9:50 – Intermission

10:10 – 157. Introduction of atrazine-degrading *Pseudomonas sp.* strain ADP to enhance rhizodegradation of atrazine. **C.-H. Lin**, B. M. Thompson, H.-Y. Hsieh, R. N. Lerch, R. J. Kremer, H. E. Garrett

10:30 – 158. Enzyme enabled remediation of pesticide residues. **C. Begley**

10:50 – Round Table Discussion - Reducing Pesticide Impacts: Problems, Progress, and Prospects

Pesticides in Urban Settings and Aggregate Human Exposures
D. Stout, *Organizer, Presiding*

Section C
The Moscone Center – Room 3005 West Bldg

9:00 – 159. Pesticide occurrence in U.S. homes: Research design for The National Children's Study. **S. J. Bedosky**, **A. C. Newcombe**, M. Heikkinen, M. Dellarco, J. Quackenboss

9:25 – 160. Urban pesticide exposure: Observations from the California Pesticide Illness Surveillance Program. **L. N. Mehler**, M. O'Malley, T. Barry

9:50 – 161. Pest management and pesticide use in California child care centers. **A. Bradman**, C. Dobson, V. Leonard, B. Messenger

10:15 – Intermission

10:30 – 162. Non-crop IPM programs and a proposal to incorporate pesticide exposure potential into the management scheme. **C. Lunchick**, P. Kwiatkowski

10:55 – 163. Use of Vikane® gas fumigant (sulfuryl fluoride) for eliminating bed bugs (*Cimex lectularius*) infesting structures and furnishings. **E. Thoms**, D. Miller

11:20 – 164. Design and development of an "Always Active" termite baiting system. **M. Smith**, J. DeMark, J. Eger, M. Fisher, R. Hamm, M. Lees, J. McKern, E. Thoms, M. Tolley

Symposium and Celebration in Honor of Professor John Casida
J. Johnston, *Organizer*
L. Ruzo, *Organizer, Presiding*

Section D
The Moscone Center – Room 3007 West Bldg

8:00 –Introductory Remarks

8:15 – 165. Exploring insecticide neurotox and detox. **J. E. Casida**

8:40 – 166. Development of novel sarin surrogates and novel blood-brain barrier-penetrating oxime antidotes to organophosphate inhibition of acetylcholinesterase. **J. E. Chambers**, H. W. Chambers

9:05 – 167. Molecular interactions of highly selective carbamates with acetylcholinesterase of the malaria mosquito, *Anopheles gambiae*. **J. Bloomquist**, T. Anderson, P. Carlier, J. Hartsell, Y. Jiang, P. Lam, M. Ma, J. Mutunga, D. Swale, M. Totrov, D. Wong

9:30 – 168. Butterflies to blood pressure with JEC: The soluble epoxide hydrolase as a target for treating diabetes, hypertension, inflammation and pain. **B. D. Hammock**, S. S. Gill

9:55 – Intermission

10:35 – 169. Annotating the role of monoacylglycerol lipase in the brain and in cancer. **D. K. Nomura**, J. Z. Long, J. E. Casida, B. F. Cravatt

11:00 – 170. Teratogenesis of organophosphorus insecticides (OPI) in chicken embryos linked to diminished NAD^+: OPI structural requirements and altered protein expression. **J. Seifert**

11:25 – 171. Spiroindolines reveal a novel target protein for insecticide action. A. Sluder, R. Clover, S. Shah, M. She, L. Hirst, P. Cutler, T. Flury, C. Stanger, A. Flemming, **F. Earley**, E. Hillesheim, L.-P. Molleyres

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AGRO Division Tuesday Poster Session

New Developments in Agrochemicals
B. Bret, J. Gan, and K. Racke *Organizers*
J. Johnston, *Organizer, Presiding*

9:30 AM – 4:00 PM
Authors Present 9:45 – 10:45 AM and 2:45 – 3:45 PM

Section E
The Moscone Center – Room 3011 West Bldg

AGRO Education Awards for Student Research Presentations
Financially supported by Bayer CropScience

172. Abiotic reduction of dichloroacetamide safeners: Transformations and fate of "inert" agrochemical ingredients. **J. D. Sivey**, A. L. Roberts

173. Evaluation of novel insecticide (Proteus 170 O TEQ) for the routine protection of cocoa farms against the brown cocoa mirid (Sahlbergella singularis) in Nigeria. **E. U. Asogwa**

174. Uptake of 17α-ethynylestradiol and triclosan into plants. **A. Karnjanapiboonwong**, A. N. Morse, T. A. Anderson

175. Experimental evidence for allosteric solvent effects between mosquito-selective carbamates and the malaria vector, *Anopheles gambiae*. **D. Swale**

176. DDA excretion in chickens following low level DDT feeding. **Z. Chen**, A. Joseph, L. Cui, R. I. Krieger

177. Evaluation of new carbamate insecticides for neurotoxicity to non-target species. **Y. Jiang**, F. Ekström, P. Carlier, J. Hartsell, M. Ma, J. R. Bloomquist

178. Simultaneous analysis of sulfonamides, tetracyclines, and free and conjugated estrogens in an agricultural watershed by LC/MS/MS. **J. Tso**, S. Inamdar, D. S. Aga

179. Residue dynamics of procymidone in leeks and soil in greenhouses by smoke generator application. **L. Chen**, C. Pan, R. I. Krieger

180. Rubber latex gloves as a potential dermal dosimeter for measuring multiple pesticide residues in strawberry harvesters. **G. Sankaran**, Y. Li, Z. Chen, T. Lopez, L. Cui, W.-G. Song, H. Vega, R. I. Krieger

181. Serial invasive signal amplification for the determination of *kdr* allele frequencies in global human head louse populations for efficient resistance monitoring. **D. J. Previte**, H. E. Hodgdon, K. S. Yoon, H. J. Kim, G. E. Abo El-Ghar, S. H. Lee, J. M. Clark

182. RNAi knockdown of ABC transporters causes decreased tolerance to DDT in the highly DDT-resistant *91-R* strain of *Drosophila melanogaster*. **J. P. Strycharz**, S. H. Lee, W. Sun, B. R. Pittendrigh, J. M. Clark

183. Community-assisted approach to managing host-pathogen interactions of mosquitoes and amphibians in nitrogen-enriched agricultural landscapes. **J. M. Sonn**, T. D. Anderson

184. Effects of carvacrol and nootkatone on [^{14}C]-nicotine binding to the house fly nicotinic acetylcholine receptor. **F. Tong**, J. R. Coats

185. Adducts from reactions of aryloxyacetic/propanoic acid herbicides with DNA in plants. **D. R. Hall**, D. W. Boerth

186. Development of a high throughput assay to screen natural insecticides: A green chemistry approach to targeting an α-adrenergic-like octopamine receptor from the American cockroach. **A. D. Gross**, M. J. Kimber, P. Ribeiro, J. R. Coats

187. Environmental fate of erythromycin in aquatic microcosms. **A. M. Jessick**, T. B. Moorman, J. R. Coats

188. Withdrawn

189. Sorption and desorption of ^{14}C-labeled permethrin on concrete. **W. Jiang**, J. Gan, D. Haver, F. Spurlock

Environmental Fate and Transport

190. Microbial degradation of etofenprox in a flooded California rice soil. **M. E. Vasquez**, D. Holstege, R. S. Tjeerdema

191. Effect of organic waste soil amendments on fate of MCPA in agricultural soils. **A. Cabrera**, A. Cañamero, P. Velarde, L. Cox, J. Cornejo, W. C. Koskinen

192. PRZM groundwater modeling predictions for a modified acetochlor soil restriction on corn, cotton, and soybeans. **T. L. Negley**, P. E. Goodrum, A. C. Newcombe, D. I. Gustafson, I. van Wesenbeeck

Pesticide Mitigation Strategies for Surface Water Quality

193. Detection and quantification of atzA in rhizosphere soil and enhanced bioremediation of atrazine by *Pseudomonas sp.* strain ADP. B. M. Thompson, **C.-H. Lin**, H.-Y. Hsieh, R. N. Lerch, R. J. Kremer, H. E. Garrett

194. Assessment of zero-valent iron and *Bacillus subtilis* for the degradation of butachlor from synthetic water. **B.-T. Oh**, Y. You, J.-H. Shim, S.-H. Choi, J.-Y. Lee, H. J. Kim, S. Kamala-Kannan

195. Use of the Riparian Ecosystem Management Model (REMM) to predict novaluron off-field loading trapment by a vegetative filter strip using data from a simulated rainfall vegetative filter strip effectiveness study. **R. Everich**, T. L. Estes, A. C. Newcombe, M. T. Nett

Pesticides and Urban Water Quality: Monitoring, Modeling and Mitigation

196. Sorption of naphthalene and 1-napthol to turfgrass thatch as influenced by thatch chemical properties. R. M. Leshin, **M. J. Carroll**

197. Survey of replacement pesticides in Ventura County watersheds. **L. I. Delgado-Moreno**, K. Lin, F. Ernst, W. Smith, R. Veiga Nascimento, J. Gan

198. Pyrethroid pesticide analysis in wastewater effluent by NCI GCMS SIM. **P. W. Halpin**, R. L. Heines

Sterling B. Hendricks Memorial Lectureship

Sponsored by AGFD and
USDA Agricultural Research Service
Cosponsored by AGRO
K. Kaplan and M. H. Tunick, *Organizers*
S. O. Duke, *Organizer, Presiding*

The Moscone Center - Room 3016 West Bldg

11:30 — Award Presentation. **Dr. Edward Knipling**.

11:45 —AGFD 103. Award Address. Development of cellulosic biofuels. **C. R. Somerville**

12:45 — Reception

TUESDAY AFTERNOON

AGRO Poster Session & Coffee
Section E
The Moscone Center – Room 3011 West Bldg
9:30 – 4:00
Papers 172 – 198. See previous listings.

Comparing Conventional and Biotechnology-Based Pest Management
Herbicides and Herbicide-Tolerant Crops
Financially supported by CropLife International
K. Carstens, S. Duke and N. Storer, *Organizers*
W. Ridley, *Organizer, Presiding*

Section A
The Moscone Center — Room 3001 West Bldg

1:30 – 199. Herbicide tolerant crops: Utilities and limitations for herbicide resistant weed management. **J. M. Green**, M. D. K. Owen

1:55 – 200. Genetic engineering of crops for resistance to treatment with the herbicide dicamba. **D. Weeks**, W. Z. Jiang, M. Behrens, N. Mutlu, T. Clemente

2:20 – 201. Development and performance assessments of DNA and protein-based detection methods for biotech products. **D. Grothaus**, D. W. Mittank

2:45 – Intermission

3:05 – 202. Improving and preserving high-performance weed control in herbicide tolerant crops: Development of a new family of herbicide tolerant traits. **T. R. Wright**, J. M. Lira, T. A. Walsh, D. M. Merlo, N. L. Arnold, J. Ponsamuel, G. Lin, D. R. Pareddy, B. C. Gerwick, C. Cui, D. M. Simpson, T. K. Hoffman, M. A. Peterson, L. B. Braxton, M. Krieger, G. Shan, L. A. Tagliani, C. Blewett, I. Gatti, R. A. Herman, D. Fonseca, R. S. Chambers, G. Hanger, M. Schultz

3:30 – 203. Glufosinate metabolism and mechanism of action in tolerant and non-tolerant plants. **S. C. Dacus**

3:55 – 204. Evaluation of compositional equivalence for multi-trait biotechnology crops. **W. P. Ridley**, G. G. Harrigan, K. C. Glenn

Pesticides and Urban Water Quality: Monitoring, Modeling and Mitigation
Financially supported by Syngenta
J. Gan *Organizer*
P. Hendley and F. Spurlock, *Organizers, Presiding*

Section B
The Moscone Center — Room 3003 West Bldg

1:30 – Introductory Remarks

1:35 – 205. Urban runoff as a source of pyrethroid pesticides and their effects on surface water bodies. **D. P. Weston**, M. J. Lydy

1:55 – 206. Urban pesticide monitoring in northern and southern California: A regional look at urban pesticides in surface waters. **M. Ensminger**, K. Kelley, F. Spurlock, K. Goh, L.-M. L. He

2:15 – 207. Pesticide pollution in runoff from northern and southern California neighborhoods. **L. Oki**, D. Haver, S. Bondarenko, J. Gan

2:35 – 208. Fipronil and metabolites in runoff from residential homes. **J. Gan**, S. Bondarenko, K. Lin, L. Oki, D. Haver

2:55 – Intermission

3:15 – 209. Distribution and toxicity of pesticides and other contaminants in stream sediments in relation to urbanization. **L. H. Nowell**, P. W. Moran, N. E. Kemble, C. G. Ingersoll, K. M. Kuivila

3:35 – 210. Pesticide toxicity in urban creeks of Sacramento, California. **I. Werner**, L. Deanovic, L. Oki

3:55 – 211. Potential influence of physical habitat, pyrethroids, and metals on benthic communities in a residential California stream. **L. Hall, Jr**, W. Killen, R. Anderson, R. Alden III

4:15 – 212. Sediment associated contaminants in urban streams: Pyrethroids and other current-use pesticides. **M. L. Hladik**, K. M. Kuivila

Pesticides in Urban Settings and Aggregate Human Exposures
D. Stout, *Organizer, Presiding*

Section C
The Moscone Center — Room 3005 West Bldg

1:30 – 213. Contribution of diet to pesticide exposure in pregnant women and children. **A. Bradman**, L. Quirós-Alcalá, R. Castorina, D. B. Barr, M. Harnly, T. E. McKone, B. Eskenazi

1:55 – 214. Pesticides and PCBs detected in the milk of women residing in urban and agricultural communities of California. **R. Weldon**, M. Davis, C. Trujillo, A. Bradman, D. Barr, N. Holland, B. Eskenazi

2:20 – 215. Presence of organophosphorous pesticides and diakylphosphates in house dust from urban and farmworker homes and their association with urinary diakylphosphate metabolite levels. **L. Quirós-Alcalá**, K. D. Smith, G. Weeresekera, M. Odetokuns, D. B. Barr, M. Nishioka, B. Eskenazi, A. Bradman

2:45 – Intermission

3:00 – 216. Evidence that the DAP biomarker may lead to overestimates of organophosphate pesticide exposure. **N. D. Forsberg**, R. Rodriguez-Proteau, C. Maier, J. Morre, G. Wilson, K. A. Anderson

3:25 – 217. PON1 as a predictor of differential susceptibility of children to organophosphate pesticides. B. Eskenazi, **A. Marks**, K. Harley, K. Huen, A. Bradman, N. Holland, C. Johnson, D. B. Barr

3:50 – 218. Preliminary examination of the movement of select insecticides following their application to simulated cracks and crevices in the US EPA Indoor Air Quality (IAQ) Research House. **D. M. Stout II**, M. A. Mason, M. S. Clifton

Symposium and Celebration in Honor of Professor John Casida
L. Ruzo, *Organizer*
J. Johnston, *Organizer, Presiding*

Section D
The Moscone Center — Room 3007 West Bldg
1:15 – 219. Mechanisms of pyrethroid selectivity. **D. M. Soderlund**

1:40 – 220. Pyrethroid mode(s) of action. **D. W. Gammon**, M. F. Leggett, J. M. Clark

2:05 – 221. Second generation pyrethroids and the cream of the crop, deltamethrin. **D. A. Pulman**

2:30 – 222. Pyrethroids: Mammalian metabolism and toxicity. **H. Kaneko**

2:55 — Intermission

3:35 — 223. Ryanodine receptors: From discovery to molecular and cellular targets for non-coplanar PCBs and related compounds of concern to environmental health. **I. N. Pessah**

4:00 — 224. Award Address (ACS Award for Team Innovation Sponsored by the ACS Corporation Associates). Anthranilic diamide insecticides: Selective activators of insect ryanodine receptors. **D. Cordova**

4:25 — 225. Phytomonitoring and phytoremediation of agrochemicals and related compounds based on recombinant P450s and AhRs. **H. Ohkawa**

4:50 — Concluding Remarks

WEDNESDAY MORNING

AGRO Poster Session & Coffee
Section E
The Moscone Center – Room 3011 West Bldg
9:30 – 4:00
Papers 258 – 285. See subsequent listings.

Comparing Conventional and Biotechnology-Based Pest Management
Insecticides and Insect-Tolerant Crops
Financially supported by CropLife International
S. Duke and W. Ridley, *Organizers*
K. Carstens and N. Storer, *Organizers, Presiding*

Section A
The Moscone Center – Room 3001 West Bldg
8:00 – Introductory Remarks

8:05 — 226. Role and impact of Bt transgenic cotton on integrated pest management. **S. Naranjo**

8:30 — 227. Trends in concentrations and use of agricultural herbicides for Corn Belt rivers, 1996-2006. **R. Gilliom**, A. Vecchia, D. Sullivan, J. Martin

8:55 — 228. U.S. EPA regulation of plant-incorporated protectants: Assessment of impacts of gene glow from pest resistant plants. **C. Wozniak**, J. Martinez

9:20 – 229. Approaches to tier-based non-target organism testing of RNAi pest control traits. **J. Huesing**, F. Lloyd, S. Levine, T. Vaughn

9:45 – 230. Relevance of traditional IPM strategies for commercial corn producers in a transgenic agroecosystem: A bygone era?. **M. Gray**

10:10 – Intermission

10:25 – 231. Resistance evolution in insects: Bt crops vs. insecticides. **R. Roush**, N. Storer, T. Shelton

10:50 – 232. Differences between ecological risk assessments for transgenic crops and chemical pesticides: The role of the environment in mitigating adverse effects. **A. Raybould**

11:15 – 233. Conventional vs. transgenic insect-resistant plants: Relative impacts on non-target organisms. **A. Shelton**, S. Naranjo, J. Romeis, R. Hellmich, M. Chen

11:40 – 234. Considerations for environmental risk assessment assay development: Differences between conventional pesticides and biotech crops. **K. Carstens**

12:05 – 235. What does the agroecosystem look like? Stacks, pyramids and chemicals. **R. Hellmich**, S. Moser, J. Kroemer

12:30 – Concluding Remarks

Pesticides and Urban Water Quality: Monitoring, Modeling and Mitigation
Financially supported by Syngenta
F. Spurlock, *Organizer*
J. Gan and P. Hendley, *Organizers, Presiding*

Section B
The Moscone Center — Room 3003 West Bldg

9:00 – 236. Approaches to assessing the risk to aquatic organisms from pyrethroids in the urban landscapes of California. **M. Dobbs**, J. Giddings, K. Henry, P. Hendley

9:20 – 237. Potential impacts of pyrethroid pesticides on the marine environment. **B. M. Phillips**, B. S. Anderson, J. W. Hunt, J. P. Voorhees, K. Siegler, R. S. Tjeerdema

9:40 – 238. Effect of sediment organic content and quality on the toxicity of the pyrethroid insecticide cypermethrin. **J. Giddings**, M. Dobbs, K. Henry, G. Mitchell, J. Schupner, D. Tessier, C. Picard

10:00 – 239. Comparison of targeted sediment sampling methods for pyrethroids in urban/residential sediments of a California stream. **L. Hall, Jr**, W. Killen, R. Anderson

10:20 – Intermission

10:35 – 240. Analytical challenges of assessing pyrethroid concentrations in aquatic environments. **D. M. Tessier**

10:55 – 241. Washoff of formulated pyrethroid insecticides from concrete surfaces. **T. M. Young**, B. Jorgenson

11:15 – 242. Offsite transport potential of urban-use insecticides from concrete surfaces. **W. Jiang**, J. Gan, D. Haver, F. Spurlock

11:35 – 243. Comparison of pyrethroid insecticide wash-off from urban surfaces. **B. C. Jorgenson**, T. M. Young

Efficient Application of Pesticides for Sustainable and Effective Crop Protection
Technologies for Effective Applications
Financially supported by CropLife America
A. Barefoot and C. Ramsay, *Organizers*
E. Ozkan, *Organizer, Presiding*

Section C
The Moscone Center — Room 3005 West Bldg

8:20 – Introductory Remarks

8:30 – 244. Advances in pesticide application technology. **G. Doruchowski**

9:00 – 245. Droplet size recommendations for crop protection products. **G. R. Ramsey**

9:20 – 246. Electronic canopy characterization and real-time variable rate application in precision orchard spraying. **S. Planas de Martí**, J. R. Rosell, A. Escolà, R. Sanz

9:40 – 247. Applying Force CS insecticide using direct injection technology in a closed-handling central insecticide system. **R. N. Ramalingam**, M. Ledson, D. Mack

10:00 – Intermission

10:15 – 248. Classification of spray quality and it's effect on drift management and field efficacy. **R. E. Wolf**

10:35 – 249. Influence of target surfaces and adjuvants on deposition characteristics of spray droplets. L. Xu, Y. Yu, H. Zhu, **E. Ozkan**

10:55 – 250. Surfactant actions on glyphosate uptake and translocation in velvetleaf plants. **P. C. C. Feng**, J. J. Sandbrink, R. D. Sammons

11:15 – 251. Spray droplet size optimization through the synergistic combination of nozzle type and novel formulation additives. **S. L. Wilson**, B. Downer, K. Qin, L. Liu, H. Tank

11:35 – Discussion

Symposium and Celebration in Honor of Professor John Casida
J. Johnston, *Organizer*
L. Ruzo, *Organizer, Presiding*

Section D
The Moscone Center – Room 3007 West Bldg

8:30 – Introductory Remarks

8:45 – 252. Deciphering ligand-receptor interactions on nicotinic acetylcholine receptors using engineered affinity labeling reactions. **M. Goeldner**, S. Charon, J. Rodrigo

9:10 – 253. Unique neonicotinoid binding conformations conferring selective receptor interactions. **M. Tomizawa**

9:35 – 254. Withdrawn

10:00 – 255. Understanding the mechanisms of spinosad resistance in insects. **J. G. Scott**

10:25 – Intermission

11:05 – 256. Effect of $GABA_A$ receptor subunit composition and agonist on noncompetitive antagonist sensitivity and selectivity. **L. Chen**, L. Xue, J. Casida

11:30 – 257. Mode of action of *Bacillus thuringiensis* toxins. **S. Gill**, M. Soberon, A. Bravo

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AGRO Division Wednesday Poster Session

New Developments in Agrochemicals
A. Garrison, J. Johnston, K. Maruya and K. Racke, *Organizers*
L. Ruzo, *Organizer, Presiding*

9:30 AM – 4:00 PM
Authors Present 9:45 – 10:45 AM and 2:45 – 3:45 PM

Section E
The Moscone Center – Room 3011 West Bldg

Symposium and Celebration in Honor of Professor John Casida

258. Synthesis of labeled ambroxol and its major metabolites. **B. Latli**

259. Isolation and inhibitory activities of Okinawan plants metabolites against HIV-1 encoding enzymes. **S. Tawata**, A. Upadhyay, T. Makise

260. Establishment of analytical method for fenhexamid residue in several representative crops. **H. Lee**, H. Park, Y. Na, M. Riu, H. Song, Y. S. Keum, J.-H. Kim

261. Identification and characterization of chlorpyrifos-methyl degrading *Chryseobacterium* sp. strain KR200. **J. Kim**, Y. Ahn

262. Improved measurement of sulfur mustard exposure: Hypochlorite oxidation of urinary ß-lyase metabolites to 1,1'-sulfonyl[2-(methylsulfinyl)ethane], automated 96 well plate SPE and isotope dilution electrospray LC-MS-MS with simultaneous column regeneration. **W. M. Draper**, J. V. Chithalen

263. Toxaphene the mysterious insecticide: Past, present and future. **M. A. Saleh**

264. PBPK and probabilistic models for estimating rodenticide exposure and risk to nontarget birds of prey. K. E. Horak, B. A. Rattner, **J. J. Johnston**

265. Design and synthesis of isoxazoles and isoxazolines with structural similarities to fipronil. **R. E. Sammelson**, D. Miller, C. Bailey

266. Are juvenile hormone (JH) analog insecticides metabolized by JH esterase?. **S. G. Kamita**, A. I. Samra, J.-Y. Liu, A. J. Cornel, B. D. Hammock

267. Effect of omethoate on the activity of cadinene synthase of cotton seedlings. **X. Shi**, W. Yang, L. Zhong, P. Liang, X. Gao

268. Metabolism of fenvalerate by human liver microsomes. **J.-H. Kim**, S.-W. Park, H.-W. Park, H. Lee, E.-H. Kim, Y. S. Keum

269. *Anopheles gambiae*-selective, meta-substituted aryl carbamates for control of malaria. **M. Ma**, J. A. Hartsel, T. D. Anderson, J. Mutunga, D. M. Wong, P. C.-H. Lam, M. M. Totrov, J. R. Bloomquist, **P. R. Carlier**

Third Agrochemical Symposium on Modern Chiral Pesticides: Enantioselectivity and its Consequences

270. Effect of chitosan on the enantioselective ecotoxicity of herbicide dichlorprop in three algae. **Y. Wen**, H. Chen, W. Liu

271. Enantioselective toxicity of organophosphorus compounds: Malathion, malaoxon and isomalathion. **A. Zhang**, X. Xie, J. Ye, C. Lin

272. Opening a new door of understanding the endocrine disruption: The enantioselective estrogenic activity of SPs. C. Wang, Q. Zhang, X. Zhang, **M. Zhao**, W. Liu

273. Enantioselectivity on zebrafish embryo toxicity of synthetic pyrethroids. **C. Xu**, M. Jin, Y. Zhang, W. Liu

274. Enantioselectivity in environmental safety of chiral pesticides. **W. Liu**, **Y. Ma**, J. Gan

275. Enantioselective behavior of metolachlor in maize root in hydroponics. **H. Liu**, F. Xie, D. Xu

276. Enantioselectivity in endocrine disruption and effect on development of breast cancer of *o*,*p*'-DDT. **L. Wang**, P. Zhou

277. Improvement of stereoselective bioassays on pesticide design: An example of methamidophos and its derivatives. **S. Zhou**, **W. Liu**

278. Enantioselective toxicity in the zebrafish embryo-larval development of insecticide bifenthrin. **M. Jing**, Y. Zhang, **W. Liu**

279. Enantioselective effects of organophosphorus pesticide on earthworm biomarkers. **Y. Ma**, L. Chen, **W. Liu**

280. Enantioselective induction of endocrine system related gene transcription by permethrin enantiomers in embryo zebrafish *(Danio reio)*. **Z. Fu**, Y. Jin, R. Jiang, L. Shu

281. Induction of genes related the innate immune system by permethrin enantiomers in embryo zebrafish (*Danio rerio*). **Y. Jin**, R. Jiang, Z. Fu

282. Synthesis and antiviral bioactivities of novel chiral bis-thiourea-type derivatives containing α-aminophosphonate moiety. **S. Yang**

Emerging Contaminants in California's Coastal and Estuarine Ecosystems.

283. Phase distribution of PBDEs in sediment-water-DOM systems. **W. Wang**, L. Delgado Moreno, J. Gan

284. Potential contribution of pyrethroids and fipronil to toxicity observed in sediments from an urban estuary. **W. Lao**, D. Tsukada, D. J. Greenstein, S. M. Bay, K. A. Maruya

285. Untargeted analysis of organic contaminants in dolphin blubber using DSI-GC×GC/TOF-MS. **E. Hoh**, S. J. Lehotay, K. C. Pangallo, C. M. Reddy

WEDNESDAY AFTERNOON

AGRO Poster Session & Coffee
Section E
The Moscone Center – Room 3011 West Bldg
9:30 – 4:00
Papers 258 – 285. See previous listings.

Emerging Contaminants in California's Coastal and Estuarine Ecosystems
Management and Prioritization
M. Hladik, S. Klosterhaus, K. Maruya and P. Rice, *Organizers*
K. Armbrust and M. Sedlak, *Organizers, Presiding*

Section A
The Moscone CenterRoom – 3001 West Bldg

1:30 – Introductory Remarks

1:40 – 286. California State Water Resources Control Board recycled water policy: Constituents of emerging concern expert panel. **F. S. Moss**

2:05 – 287. The ocean is not forgotten: Integrating California's CEC approach. **D. George**

2:30 – 288. Emerging contaminants: Prioritization considerations for water reuse in California. **C. Stacklin**

2:55 – Intermission

3:15 – 289. Towards an early warning system for contaminants of emerging concern (CECs): A multiagency Mussel Watch pilot study in California. K. Kimbrough, G. Lauenstein, J. Christensen, T. Collier, K. Smalling, E. Furlong, D. Alvarez, J. Kucklick, L. Huff, D. Gregorio, S. Klosterhaus, M. Sedlak, S. Weisberg, **K. Maruya**

3:40 – 290. Prioritization of emerging contaminants for management response: Pesticides example. **K. D. Moran**

4:05 – 291. Complexities surrounding the environmental impact of drug disposal. **I. Ruhoy**, C. Daughton

Pesticides and Urban Water Quality: Monitoring, Modeling and Mitigation
Financially supported by Syngenta
P. Hendley, *Organizer*
J. Gan and F. Spurlock, *Organizers, Presiding*

Section B
The Moscone Center – Room 3003 West Bldg

1:30 – 292. Conceptual model for transport of pesticides used in urban areas into surface waters. **K. D. Moran**

1:50 – 293. Transport of insecticides to urban streams in California: A refined conceptual model and problem formulation. **P. Hendley**, J. Giddings, R. Jones, M. Dobbs

2:10 – 294. Advances in modeling urban/residential pesticide runoff. **W. M. Williams**, A. M. Ritter, J. M. Cheplick

2:30 – 295. Urban pesticide use support system. **G. Hoogeweg**, W. M. Williams, A. M. Ritter

2:50 – Intermission

3:05 – 296. Use of a storm water management model for diagnosis of residential exposure issues. **S. H. Jackson**, D. Haver, L. Oki

3:25 – 297. Modeling the effects of landscape best management practices on water quality in urban residential areas. **A. D. Manfree**, A. E. Bale, S. E. Greco, L. Oki, D. L. Haver, J. Gan, S. Bondarenko

3:45 – 298. Pesticide detections in washoff from residential hardscapes generated at defined intervals. **D. L. Haver**, T. J. Majcherek, S. Bondarenko, J. Gan

4:05 – 299. Outreach and training for professional and non-professional pesticide applicators for urban pesticide runoff mitigation. **C. Wilen**, D. Haver, J. Gan, J. Strand, M. L. Flint, M. Rust

Efficient Application of Pesticides for Sustainable and Effective Crop Protection
Technologies for Effective Applications
Financially supported by CropLife America
E. Ozkan and C. Ramsay, *Organizers*
A. Barefoot, *Organizer, Presiding*

Section C
The Moscone Center – Room 3005 West Bldg
1:25 – Introductory Remarks

1:30 – 300. Effects of the atomization process on spray quality. **W. E. Bagley**

1:50 – 301. Low volume application of insecticides for the Asian citrus psyllid management in Florida. **D. R. Boina**, P. J. Clayson, M. Salyani, L. L. Stelinski

2:10 – 302. Air-assisted, electrostatic-induction, crop-spraying technology: Review of basic physics and engineering underlying the reduced-volume, reduced-diameter droplet deposition process. **S. E. Law**

2:40 – Intermission

3:00 – 303. Generalised dose adjustment calculator for orchard spraying. **P. J. Walklate**, J. Cross

3:20 – 304. Using drift reduction adjuvants to increase deposition of pesticides. **J. Garr**

3:40 – 305. Reality check: Current practices in pesticide application and management of pesticide waste. **E. Ozkan**

4:00 – Discussion

Symposium and Celebration in Honor of Professor John Casida
L. Ruzo, *Organizer*
J. Johnston, *Organizer, Presiding*

Section D
The Moscone Center – Room 3007 West Bldg

1:15 – 306. Biomimetic chemistry as a useful tool for studying reactive metabolites of pesticides. **Y. Segall**

1:40 – 307. Legacy of environmental and metabolic activation. **D. R. Dohn**, L. O. Ruzo

2:05 – 308. Metabolism and toxicological studies of environmental chemicals: From chemical and microsomal oxidation reactions to metabolism reactions in transgenic plant cell cultures containing the mammalian p450 monooxygenase system. **I. Schuphan**

2:30 – 309. NMR at the PCTL in Berkeley in the 1980s and beyond. **I. Holden**

2:55 – Intermission

3:35 – 310. Proteomics in bacterial metabolism of pesticides. **Q. X. Li**

4:00 – 311. Plant peroxygenase: From detoxication to signalling. **E. Blee**

4:25 – 312. Theoretical molecular descriptors relevant to the uptake of persistent organic pollutants from soil by zucchini: A QSAR study. **T. Komives**, I. Belai, B. Bordas

4:50 – Concluding Remarks

THURSDAY MORNING

Emerging Contaminants in California's Coastal and Estuarine Ecosystems
Occurrence, Fate and Bioavailability
K. Armbrust, M. Hladik, P. Rice and M. Sedlak, *Organizers*
S. Klosterhaus and K. Maruya, *Organizers, Presiding*

Section A
The Moscone Center – Room 3001 West Bldg

8:30 – Introductory Remarks

8:40 – 313. Endocrine disruptors and pharmaceuticals in California coastal waters. **S. Snyder**, D. Vidal-Dorsch, S. Bay, K. Maruya

9:05 – 314. Determination of pharmaceuticals in nearshore marine sediment samples from the Southern California Bight. **E. T. Furlong**, S. L. Werner, A. S. Pait, M. Choi, K. Maruya, H. Choi

9:30 – 315. Emerging contaminants and trace organics in wastewater and solids at the San Jose/Santa Clara Water Pollution Control Plant. **E. G. Dunlavey**, D. Tucker, J. Ervin

9:55 – Intermission

10:15 – 316. Ubiquitous distribution of alkylphenols: The next emerging wave of endocrine disruptors along coastal waters. **L. Tomanek**, J. Diehl, S. Johnson, S. The

10:40 – 317. High PCB and low PBDE exposures in pelagic North Pacific albatrosses. **S. Harwani**, J.-S. Park, R. W. Henry, A. Rhee, P. Patel, D. A. Croll, K. Hooper, M. Petreas

11:05 – 318. Status and trend of classic and emerging brominated flame retardants in California wildlife and their exposure pathways. **J.-S. Park**, A. Holden, V. Chu, S. D. Newsome, R. W. Henry, F. Allison, M. Karen, J. P. Nicholas, J. Linthicum, K. Hooper

11:30 – 319. Influence of sediment-amendment with single-walled carbon nanotube on microbial availability of polycyclic aromatic compounds. **X. Cui**, F. Jia, J. Gan, Y. Chen

Third Agrochemical Symposium on Modern Chiral Pesticides: Enantioselectivity and its Consequences
J. Gan and A. Garrison, *Organizers*
W. Liu, *Organizer, Presiding*

Section B
The Moscone Center – Room 3003 West Bldg

8:30 – Introductory Remarks

8:40 – 320. Enantioselective separation and analysis of synthetic pyrethroids. **J. Ye**, M. Jin, **W. Liu**

9:05 – 321. Integrative assessment of enantioselectivity in environmental safety of modern chiral pesticides. **M. Zhao**, W. Liu

9:30 – 322. Comparison of the enantiomer distribution of chiral organochlorine contaminants in captive West Greenland sledge dogs and East Greenland polar bears. **C. S. Wong**, M. S. Ross, R. J. Letcher, M. A. McKinney, C. Sonne, R. Dietz

9:55 – 323. Phytotoxicity and environmental fate of chiral herbicides. **Q. Zhou**, Y. Zhang, **L. Weiping**

10:20 – Intermission

10:50 – 324. Enantiomer selective estrogen and androgen activity of chiral pesticides. **T. E. Wiese**, H. C. Segar, E. V. Skripnikova, H. Ashe, H. Li, A. W. Garrison

11:15 – 325. Enantioseparation of new quinazoline derivatives with α-aminophosphonate moiety on polysaccharide chiral stationary phases by high performance liquid chromatography. **Z. Wu**

11:40 – 326. Degradation and racemization of haloxyfop-methyl and free haloxyfop enantiomers in soil investigated by enantioselective HRGC and various mass spectrometric detection techniques. **M. D. Müller**, T. Poiger, H.-R. Buser, I. J. Buerge

12:05 – 327. Enantioselective transformation of prochiral and chiral agrochemicals as well as of emerging environmental pollutants by microorganisms. **H. Huhnerfuss**

Efficient Application of Pesticides for Sustainable and Effective Crop Protection
Drift Reduction and Drift Management
Financially supported by CropLife America
E. Ozkan, and C. Ramsay, *Organizers*
A. Barefoot, *Organizer, Presiding*

Section C
The Moscone Center – Room 3005 West Bldg

8:20 – Introductory Remarks

8:30 – 328. Pesticide labeling issues for application efficiency. **C. Ramsay**

8:50 – 329. EPA's proposed guidance to improve drift labeling of pesticide products. **J. Ellenberger**, V. LaCapra

9:10 – 330. Validation testing of drift reduction technology test protocol. **F. Khan**, J. Ellenberger, M. Kosusko

9:30 – 331. Testing and validation of EPA protocols for the evaluation of drift reduction technologies (DRTs). **B. K. Fritz**, W. C. Hoffmann

9:50 – Intermission

10:05 – 332. Management of pest control product drift using chemical methods: Current and future trends. **T. J. O'Connell**, F. Sexton

10:25 – 333. Overview of California drift management issues and drift reduction measures. **T. Barry**

10:45 – 334. Calculating spray drift buffers using FIFRA methodology. **S. H. Jackson**

11:05 – 335. Thermal inversions frequency of occurence according to one Louisiana weather station. **R. N. Barbosa**

11:25 – Discussion

Assessing Exposure of Pollinators to Systemic Pesticides
T. Gould, J. Overmyer and J. D. Wisk, *Organizers*
D. Fischer, *Organizer, Presiding*

Section D
The Moscone Center – Room 3007 West Bldg

8:45 – Introductory Remarks

8:55 – 336. How can we improve honeybee risk assessment? ICPBR proposals. **H. Thompson**, G. Lewis, A. Alix, P. Oomen, M. Coulson

9:15 – 337. Chlorantraniliprole: Risk assessment for honeybees considering spray application and systemic exposure via soil dosing. **A. Dinter**, K. E. Brugger

9:35 – 338. High levels of miticides and systemic agrochemicals in North American beehives: Implications for honey bee health. **C. A. Mullin**, M. Frazier, J. L. Frazier, S. Ashcraft, R. Simonds, D. vanEngelsdorp, J. S. Pettis

9:55 – 339. Pesticide residues in pollen collected by foraging honey bees in Connecticut. **B. D. Eitzer**, K. A. Stoner

10:15 – Intermission

10:40 – 340. Trends vs. peaks: Interpreting data for toxic chemicals in bee colonies. **C. B. Henderson**, J. J. Bromenshenk

11:00 – 341. Overview of methods used to sample pollen and nectar in exposure studies. **R. E.L. Rogers**

11:20 – 342. Field studies to assess exposure and risk of the honeybee to pesticides. **I. Tornier**

11:40 – 343. Appropriate sample materials and sampling techniques to determine the exposure level of honeybees to systemic residues in nectar and pollen of crop plants under typical agronomic conditions. **A. Nikolakis**, C. Maus, J. Keppler, P. Neumann

THURSDAY AFTERNOON

Emerging Contaminants in California's Coastal and Estuarine Ecosystems
Occurrence and Potential Impact
K. Armbrust, S. Klosterhaus, K. Maruya and M. Sedlak, *Organizers*
M. Hladik and P. Rice, *Organizers, Presiding*

Section A
The Moscone Center – Room 3001 West Bldg

1:30 – 344. Occurrence, fate, and transport of emerging contaminants in the Sacramento-San Joaquin delta. **Y. C. Guo**, S. W. Krasner, S. Fitzsimmons, C. L. DiGiorgio

1:55 – 345. Sediment contamination and biological effects relationships in California's Sacramento and San Joaquin River Delta. **S. M. Bay**, A. E. Fetscher, S. Lowe, K. Gehrts, C. Beegan

2:20 – 346. Estrogenic activity observed in the lower Napa and Sacramento Rivers: Influence of alkylphenol ethoxylate and pesticide mixtures. **D. Schlenk**, W. Jones, R. Lavado, J. Loyo-Rosales, S. Snyder, D. Sedlak

2:45 – 347. Emerging marine antifoulant Irgarol 1051 in California marinas. **Y. Sapozhnikova**, K. Schiff, N. Singhasemanon, E. Wirth, M. Fulton

3:10 – Intermission

3:30 – 348. Watershed-scale effectiveness of agricultural best management practices (BMPs) for pesticides in three California estuaries. **K. Siegler**, B. Anderson, J. Hunt, B. Phillips, K. Smalling, K. Kuivila, J. Voorhees

3:55 – 349. Occurrence and potential impacts of current-use pesticides in a central California coastal ecosystem. **K. L. Smalling**, J. L. Orlando, B. Phillips, K. Siegler, B. Anderson, J. Hunt, K. M. Kuivila

4:20 – 350. Endocrine disruption in a California estuary: Individual- and population-level effects in a resident cv fish species. **S. M. Brander**, G. N. Cherr

Third Agrochemical Symposium on Modern Chiral Pesticides: Enantioselectivity and its Consequences
J. Gan and W. Liu, *Organizers*
A. Garrison, *Organizer, Presiding*

Section B
The Moscone Center – Room 3003 West Bldg

2:00 – 351. Stereoselective metabolism of 1,2,4-triazole fungicides in hepatic microsomes and implications for risk assessment. **J. F. Kenneke**, C. S. Mazur, A. W. Garrison, R. D. Miller, T. J. Sack, C. C. Brown, J. K. Avants

2:25 – 352. Stereoselective behavior of chiral pesticides in the environment. **Z. Zhou**, P. Wang

2:50 – 353. Enantioselectivity in effects of metolachlor on Cyt 450 enzyme systems in maize and rice. **H. Liu**, M. Xiong, W. Cai

3:15 – 354. Enantioselectivity in biodegradation of current-use chiral insecticides. **J. Gan**, S. Qin, M. Nillos, K. Lin, W. Liu

3:40 – Intermission

4:05 – 355. Enantioselective phytotoxicity of imazethapyr in A*rabidopsis thaliana* and rice. H. Qian, H. Hu, W. Liu, **Z. Fu**

4:30 – 356. Enantioselective synthesis and antiviral bioactivities of novel chiral β-amino acids ester derivatives. **B. Song**

4:55 – 357. Chirality in agrochemicals: A burning issue. **I. Ali**

5:20 – Concluding Remarks

Efficient Application of Pesticides for Sustainable and Effective Crop Protection
Drift Reduction and Drift Management
Financially supported by CropLife America
A. Barefoot and E. Ozkan, *Organizers*
C. Ramsay, *Organizer, Presiding*

Section C
The Moscone Center – Room 3005 West Bldg

1:25 – Introductory Remarks

1:30 – 358. Drift reduction technologies in Australia and New Zealand. **A. Hewitt**, A. Hewitt

1:50 – 359. Regulatory and technological approaches to drift reduction in the European Union. **G. Doruchowski**

2:10 – 360. Improving spray drift management through applicator education and equipment calibration. **P. N. Klassen**

2:30 – 361. Best management practices for boom sprayers: What is in this new international standard and how can we put it to use?. **E. Ozkan**

2:50 – Discussion

Assessing Exposure of Pollinators to Systemic Pesticides
D. Fischer, T. Gould and J. Overmyer, *Organizers*
J. D. Wisk, *Organizer, Presiding*

Section D
The Moscone Center – Room 3007 West Bldg

1:30 – 362. Use of imidacloprid in California for the management of Asian Citrus Psyllid. **F. Byrne**, J. Morse

1:50 – 363. Methods to assess pollinator exposure to imidacloprid treated hardwood trees as part of the USDA-APHIS Asian Longhorned Beetle control program. **J. Pettis**, J. Johnson

2:10 – 364. Pros and cons of methods used to sample honey bee hives for analysis of pesticides and other contaminants. **J. J. Bromenshenk**, C. B. Henderson

2:30 – Intermission

2:40 – Panel Discussion

AGFD DIVISION

AGFD 103
Sterling B. Hendricks Memorial Lectureship. Development of cellulosic biofuels

C. R. Somerville, crs@berkeley.edu. Energy Biosciences Institute, University of Califo, Melvin Calvin Laboratory, MC 5230, Berkeley, California, United States

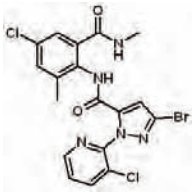
Because plants can be deployed on a large scale to capture and store solar energy, one way of moving toward the development of carbon neutral energy sources is to use plant biomass for production of fuels. The efficient production of biofuels by routes other than gasification will require innovation in three main areas: sustainable production of feedstocks that do not compete with food production, depolymerization of feedstocks, and conversion of feedstocks to fuels. In this respect there is renewed interest in identifying plants that have optimal biomass accumulation and understanding the production issues associated with large-scale cultivation and sustainable harvesting of such species. Additionally, the importance of enhancing soil carbon and nutrient retention while minimizing inputs will require an integrated approach to the development of cellulosic energy crops. The challenges on the processing side include the development of improved chemical or biological catalysts for polysaccharide and lignin depolymerization and conversion to fuels, the development of microbial strains that can convert a wide range of sugars to next generation fuels under harsh conditions, and numerous innovations in chemical engineering.

AGRO DIVISION

AGRO 1
Award Address (ACS Award for Team Innovation Sponsored by the ACS Corporation Associates). Evolution of synthetic routes to N-pyridylpyrazole anthranilic diamide insecticides: The discovery of Rynaxypyr®

T. M. Stevenson, thomas.m.stevenson@usa.dupont.com, G. P. Lahm, T. P. Selby, J. H. Freudenberger, C. M. Dubas-Cordery, B. K. Smith, K. A. Hughes, D. Cordova, L. Flexner, and C. A. Bellin. Crop Protection, DuPont, Newark, Delaware, United States

Anthranilic diamide insecticides represent a new class of highly active and environmentally friendly insecticides which act at the ryanodine receptor. During the optimization program in this area, a variety of chemical routes were required to synthesize different sub-classes of targets. This talk will trace the evolution of the chemistry used to discover the commercial insecticide Rynaxypyr® and related compounds.



AGRO 2
Award Address (ACS Award for Team Innovation Sponsored by the ACS Corporation Associates). Preparation of 3-halo-1-aryl-1H-pyrazole-5-carboxylic acids: The early process development of Ryanxypyr®

J. H. Freudenberger[1], John.H.Freudenberger@usa.dupont.com, G. D. Annis[1], and P. J. Fagan[2]. [1]Crop Protection, DuPont, Newark, Delaware, United States, [2]Central Research & Development, DuPont, Wilmington, Delaware, United States

Anthranilic diamides represent a new class of highly active and environmentally friendly insecticides which act at the Ryanodine receptor. During the discovery phase of the program, numerous analogs were prepared using pyrazolecarboxylic acids synthesized via a variety of chemical routes. As the emphasis changed towards development, work began on identifying commercial viable routes to the preferred analogs. This presentation will focus on the early process development of the pyrazole portion of Rynaxypr®.

AGRO 3
Award Address (ACS Award for Team Innovation Sponsored by the ACS Corporation Associates). Discovery of Cyazypyr™: A new anthranilic diamide ryanodine receptor activator for cross-spectrum insect control

T. P. Selby, thomas.p.selby@usa.dupont.com, G. P. Lahm, george.p.lahm@usa.dupont.com, T. M. Stevenson, K. A. Hughes, I. B. Annan, D. Cordova, C. A. Bellin, E. A. Benner, K. D. Wing, J. D. Barry, M. J. Currie, and T. F. Pahutski. Crop Protection, DuPont, Newark, Delaware, United States

Calcium channels play an important role in multiple cell functions including muscle contraction. The ryanodine receptor is a non-voltage-gated intracellular calcium channel named after the plant metabolite ryanodine found to affect calcium release by blocking this channel in the partially open state. Anthranilic diamides substituted with a *N*-pyridylpyrazole were reported to be a new class of insecticides showing potent activity against a range of Lepidoptera by causing intracellular release of calcium mediated by the ryanodine receptor. Work in this area resulted in the discovery of Rynaxypyr®, a new broad-spectrum insecticide with outstanding activity against lepidopteran pests at very low application rates. In our search for analogs with enhanced systemic properties, we pursued substitution of the anthranilic diamide at various positions with a variety of polar groups such as cyano. Here, we report on the synthesis, biology and structure-activity trends for a series of lower log P derivatives of Rynaxypyr® with an emphasis on cyano-substituted anthranilic diamides. This effort culminated in the discovery of Cyazypyr™, a second product candidate to emerge from this chemistry class showing excellent cross-spectrum activity against a wide range of insects including lepidopteran, hemipteran and coleopteran pests.

AGRO 4
Discovery of aminocyclopyrachlor: How anthranilic diamide insecticides led to a new broad-spectrum auxinic herbicide

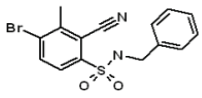
B. L. Finkelstein, Bruce.l.finkelstein@usa.dupont.com, G. Armel, S. Bolgunas, D. A. Clark, J. S. Claus, R. J. Crosswicks, W. Hong, C. M. Hirata, G. P. Lahm, T. P. Selby, and T. M. Stevenson. Crop Protection, DuPont, Newark, Delaware, United States

The anthranilic diamide insecticides Rynaxypyr® and Cyazypyr® represent one of the most promising new classes of insecticide chemistry owing to their excellent insecticidal efficacy and high margins of mammalian safety. This talk will describe the synthesis, biology and structure-activity relationships of a series of compounds containing heterocyclic modifications of the anthranilic core structure. During this work we uncovered a lead structure that led the discovery of new family of highly active pyrimidine-based auxin mimics. Effort in this area produced the commercial candidate aminocyclopyrachlor that provides outstanding broad-leaf weed control at low use rates.
Aminocylopyrachlor is very effective on many hard to control weeds and is currently being developed by DuPont for use in turf, brush and industrial weed control.

AGRO 5
Synthesis and biological activity of cyanoarylsulfonamides

W. von Deyn[1], wolfgang.deyn@basf.com, F. Kaiser[1], M. Pohlman[1], and D. Anspaugh[2]. [1]AGRO, BASF, Ludwigshafen, Germany, [2]AGRO, BASF, Research Triangle Park, North Carolina, United States

Regulatory pressures on conventional insecticide classes have increased the need for more environmentally benign alternatives. A new class of aphicides was discovered starting from the sulfonamide **1** which originated from random screening. Chemistry was developed to explore a wide scope of structural variations of the lead structure **2** including heterocyclic analogs and prodrugs. The potency of the optimized analogs was evaluated under greenhouse and field conditions. Cyanoarylsulfonamides show potential for foliar and seed treatment uses against aphids at use rates in the range of standards, with only minor effects on non-target arthropods.



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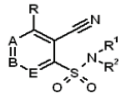

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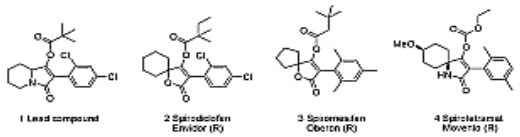
AGRO 6
Cyclic ketoenols: Discovery and chemical evolution of a new generation of resistance-breaking insecticides and acaricides

R. Fischer, reiner.fischer@bayercropscience.com, T. Bretschneider, thomas.bretschneider@bayercropscience.com, **E.-R. F. Gesing**, ernst-rudolf.gesing@bayercropscience.com, and R. Nauen. Bayer CropScience, Monheim, Germany, Germany

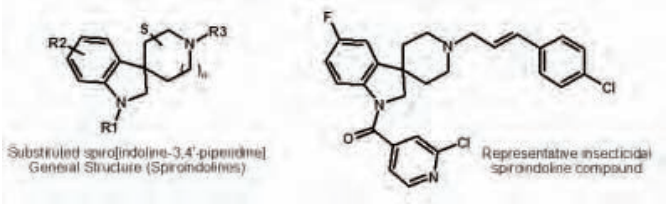
The discovery of the cyclic Ketoenols dates back about twenty years when during work on herbicidal PPO inhibitors a structure variation led to a shift in the weed spectrum and also some acaricidal activity. The structural optimization of this weak acaricidal lead **1** in respect to e.g. acaricidal spectrum and plant compatibility is shown leading finally to the commercial acaricide Spirodiclofen (**2**, Envidor®). The observation that some Ketoenol derivatives show an interesting activity against white flies initiated a second optimization program with the goal to identify a compound with a high activity against different white fly species combined with a good acaricidal activity and plant compatibility. This led to the commercial white fly and mite control compound Spiromesifen (**3**, Oberon®). A third fascinating aspect came up when some interesting aphicidal activities were observed in certain structure types. During the optimization process the search for derivatives with a favorable plant compatibility and a broad aphicidal spectrum was an important factor leading to Spirotetramat (**4**, Movento®).



AGRO 7
Spiroindolines: Discovery of a novel class of insecticides

J. Cassayre[1], jerome.cassayre@syngenta.com, D. J. Hughes[2], R. S. Roberts[4], P. A. Worthington[2], F. Cederbaum[1], P. Maienfisch[1], and L.-P. Molleyres[3]. [1]Research Chemistry, Syngenta Crop Protection AG, Stein, Switzerland, [2]Syngenta Crop Protection Jealott's Hill International Research Center, Jealott's Hill, United Kingdom, [3]Syngenta Crop Protection AG, Basel, Switzerland, [4]Almirall Prodesfarm Research Center, Barcelona, Spain

Substituted spiro[indoline-3,4'-piperidine] compounds (Spiroindolines) are a new class of insecticides, which possess a novel neuroactive mode of action and provide excellent activity against lepidopteran pests. The discovery, synthesis, biology and structure-activity relationships of these novel spiroindoline compounds will be presented.



AGRO 8
Award Adress (Kansas City Section Spencer Award). Evolution of the diamide through isoxazoline insecticides

G. P. Lahm, george.p.lahm@usa.dupont.com, J. K. Long, T. F. Pahutski, B. K. Smith, M. J. Mahaffey, J. R. Rauh, D. Cordova, R. M. Smith, and J. D. Barry. Crop Protection, DuPont, Newark, Delaware, United States

The diamide insecticides evolved from early herbicide leads into potent broad spectrum insecticides including the phthalic diamide flubendiamide and the anthranilic diamides chlorantraniliprole and cyantraniliprole. The evolution of this class has continued through the meta-diamide and isoxazoline insecticides. This talk will review the evolution of this area and focus specifically on a new class of isoxazoline insecticides with broad activity across a range of insect and mite species including synthesis, biology, site-of-action and structure-activity trends.

AGRO 9
Food safety on the farm: Movement toward the development of sustainable and environmentally compatible pre-harvest interventions for livestock producers

R. C. Anderson[1], Robin.Anderson@ars.usda.gov, D. J. Smith[2], N. A. Krueger[1], R. C. Beier[1], T. R. Callaway[1], T. S. Edrington[1], R. B. Harvey[1], and D. J. Nisbet[1]. [1]Food & Feed Safety Research Unit, United States Department of Agriculture/Agricultural Research Service, College Station, Texas, United States, [2]Biosciences Research Laboratory, United States Department of Agriculture/Agricultural Research Service, Fargo, North Dakota, United States

Pathogenic bacteria residing in the gut of food-producing animals can contaminate meat and dairy products during processing. A chlorate based feeding strategy specifically targeting respiratory nitrate reductases possessed by *E. coli* and *Salmonella* has shown promise in depopulating these pathogens. Most beneficial bacteria are not affected by chlorate. Co-administration of chlorate with select nitroalkanes, which exhibit bactericidal activity in their own right, synergistically enhances the bactericidal effect of chlorate by an undefined mechanism. The nitrocompounds are attractive because they also reduce enteric methane production which contributes > 20% of the United States' total emission of this greenhouse gas. Chemicals targeting amino acid catabolism by asaccharolytic *Campylobacter* have also shown promise in reducing the carriage of these pathogens in food animals and in conserving amino nitrogen. The application of these chemical interventions may ultimately improve the microbial safety and quality of foods produced for human consumption while limiting greenhouse gasses.

AGRO 10
Non-pheromonal control of navel orangeworm as a promising method toward decreasing contamination of *Aspergillus flavus* in California tree nuts

J. J. Beck[1], john.beck@ars.usda.gov, D. M. Light[1], B. S. Higbee[2], K. Dragull[1], G. B. Merrill[1], and W. S. Gee[1]. [1]Plant Mycotoxin Research Unit, USDA-ARS, Albany, CA, United States, [2]Paramount Farming Company, Bakersfield, CA, United States

The navel orangeworm (NOW) is a major insect pest of tree nuts and is a vector of *Aspergillus flavus* – a fungus responsible for aflatoxin contamination of California tree nuts. Despite the presence of NOW throughout a typical season, the identification of particular VOCs, or their potential role as semiochemicals, has not been addressed. Recent research has indicated semiochemical behavior from non-pheromonal, plant-derived VOCs and VOC blends. An efficacious attractant for NOW monitoring/control remains elusive despite breakthroughs with the NOW female sex pheromone. The VOC emissions of almond and pistachio orchards were collected via a large-scale ambient volatile collection system and subjected to electroantennographic (EAG) and Y-tube olfactometry bioassay. Synthetic blends mimicking the natural VOC composition and potential attractant blends were formulated and evaluated for efficacy as environmentally responsible semiochemicals for NOW.

AGRO 11
Review of antimicrobial activities of plant-derived edible compounds against susceptible and antibiotic-resistant foodborne pathogens

M. Friedman, mendel.friedman@ars.usda.gov, and C. E. Levin. Produce Safety and Microbiology, Western Regional Research Center, Agricultural Research Service, USDA, Albany, CA, United States

Consumers are concerned with the growing number of foodborne illness outbreaks caused by some pathogens. The antibiotic resistance associated with foodborne infections is another concern. For these reasons, there has been interest in developing new types of effective and safe antimicrobial compounds derived from natural sources. As part of an effort designed to develop antimicrobial food formulations that will protect both the food and the consumer against pathogenic bacteria, we evaluated the bactericidal activities of ~300 potential antimicrobials: essential oils, oil components, phenolic benzaldehydes and benzoic acids, tea catechins and theaflavins, teas, wine compounds, wines, and chitosan against one or more of the following foodborne pathogens: *Bacillus cereus*, *Campylobacter jejuni*, *Clostridium perfringens, Escherichia coli* O157:H7, *Listeria monocytogenes*, *Mycobacterium avium* subspecies *paratuberculosis*, *Salmonella enterica*, and *Staphylococcus aureus*. In this presentation, we will describe antibiotic activities of different classes of plant compounds based on data from collaborative studies and the literature. The data show that many of phytochemicals and plant extracts are highly active against both non-resistant (susceptible) and antibiotic-resistant bacteria in buffers and in contaminated liquid and solid foods. Mechanisms of antibiotic effects will also be discussed. Future studies should further define their effectiveness in human foods and animal feeds and as disinfectants of fruits, vegetables, fruit and vegetable juices, meats, seafood, and dairy foods as well as in contaminated non-food items such as cutting boards.

AGRO 12
Rapid identification of protein biomarkers and toxins from food-borne pathogens by top-down proteomics

C. K. Fagerquist, clifton.fagerquist@ars.usda.gov. U.S. Department of Agriculture, Agricultural Reseach Service, Western Regional Research Center, Albany, California, United States

Rapid characterization and identification of microorganisms is critical during an outbreak of food-borne illness. Often DNA-based techniques such as PCR (polymerase chain reaction) or PFGE (pulsed field gel electrophoresis) are used to detect the presence of virulence genes or to "type" a microorganism from a DNA band pattern. An alternative approach is to characterize/identify a microorganism on the basis of the proteins that it expresses. This approach most often utilizes mass spectrometry (MS) and specifically, matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF-MS). With the development of MALDI-TOF-TOF-MS/MS, it became feasible to isolate and fragment specific intact protein ions (without digestion) and identify them from their sequence-specific fragment ions and top-down proteomic analysis. In some cases, the sequence of the protein is sufficiently unique to identify the source microorganism. Results are presented demonstrating this approach for identification of food-borne pathogens (e.g. *Campylobacter*, *E. coli*, etc.) as well as protein toxins.

AGRO 13
Effects of gamma and ultraviolent radiation on furan formation

X. Fan, xuetong.fan@ars.usda.gov. Eastern Regional Research Center, USDA, ARS, Wyndmoor, PA, United States

Furan is a possible human carcinogen commonly known to be induced by thermal processing. Our studies have found that non-thermal processing technologies such as ultraviolent (UV) and gamma radiation could also induce furan in solutions of simple sugars and ascorbic acids, as well as fruit juices. However, little furan was induced in fresh vegetables or meat products. Low levels (ppb) of furan formation were found in gamma-irradiated fruits with high sugar content and pH below 5. Studies in model systems suggested that low pH favored formation of gamma irradiation-induced furan. Interestingly, furan in aqueous solutions and in thermally-processed ready-to-eat meat products was reduced by gamma radiation. It appears whether irradiation induced furan in a particular food would depend on the balance between furan synthesis and destruction. The mechanisms of furan formation from simple sugars and ascorbic acids will be discussed.

AGRO 14
Antimicrobial packaging: Additional intervention technology for food safety

T. Z. Jin, tony.jin@ars.usda.gov. USDA-ARS-ERRC, Wyndmoor, PA, United States

Because of recent outbreaks due to foodborne pathogen contaminations, consumers have placed greater demands on the performance of food packaging and want to be assured that the packaging is fulfilling its function of protecting the quality, freshness and safety of packaged foods. Antimicrobial packaging is the packaging system that satisfies conventional packaging requirements and is able to kill or inhibit spoilage and pathogenic microorganisms that are post-process contaminating foods caused by mishandling and faulty packaging. Antimicrobial food packaging systems using biosource/biodegradable polymers with combination of natural antimicrobial compounds have been developed at the USDA-ARS Eastern Regional Research Center and have been evaluated in real food systems including liquid foods, ready-to-eat meat and produce products. The results demonstrated that the systems significantly inhibited the growths of pathogenic *Listeria monocytogenes*, *E. coli* O157:H7 and *Salmonella enteritidis*. Antimicrobial packaging adds a final intervention hurdle to ensure safety of packaged foods.

AGRO 15
Response to invasives: The good, the bad, and new chemistries are needed

T. A. Batkin, ted@citrusresearch.org. Department of Officers, California Citrus Research Board, Visalia, CA, United States

Considerable US resources have gone into anticipating, preventing, containing, and eradicating invasive pests over the past 15 years; some approaches against certain pests have proven to be successful in preventing establishment while many pests have established pockets of infestation or have become part of the agricultural landscape. This session is to give attention to the tools being used effectively to prepare and contend with invasive pests, share lessons learned among regulators, researchers and industry, and take a critical look at where procedures need strengthening and improvement. The need for effective and environmentally safe chemistries continues to be a need in quarantines and eradication programs; we also hope this session inspires chemists to follow up using invasive pests as their targets.

AGRO 16
National perspective of the detection of and response to exotic pests

S. O'Toole[1], sotoole@aphis.usda.gov, and O. El-Lissy[1], Osama.A.El-Lissy@aphis.usda.gov. [1]USDA APHIS PPQ Emergency Domestic Programs, Riverdale, MD, United States, [2]USDA APHIS PPQ Emergency Domestic Programs, Riverdale, MD, United States

APHIS Plant Protection and Quarantine (PPQ) works with Federal agencies, State, tribal and local governments, industries, and stakeholders to implement coordinated actions designed to contain, control, or eradicate invasive plant pests newly introduced into the United States. In addition to biological and ecological considerations, PPQ and cooperators evaluate several other key factors, including environmental, economic, and international trade implications, in selecting the most appropriate response strategies. This presentation summarizes the framework currently being used in response to invasive pest outbreaks in the United States.

AGRO 17
Regulation of invasive species in California

R. Leavitt, rleavitt@cdfa.ca.gov. Department of Plant Health Services Division, California Department of Food and Agriculture, Sacramento, CA, United States

California's agriculture, horticulture, and environment are under constant threat from invasive pest species. Invasive species include insects such as the Mediterranean fruit fly which can damage citrus, stone fruit and other crops. Invasive species also include plant pathogens such as plum pox virus which damage stone fruit, quagga and zebra mussels which can block water movement in dams and aqueducts, and vertebrate species which attack growing and stored crops and grains. The California Department of Food and Agriculture maintains an extensive pest prevention program to protect California from invasive species. This includes the Border Protection Stations and Interior Pest Exclusion to keep California free on of invasive species by preventing them from entering the state. The CDFA also has a pest identification laboratory that uses the latest morphological and molecular identification and classification techniques. However, all invasive species can not be excluded so the CDFA, working with the United States Department of Agriculture and other partners maintains and early detection/rapid response capability to control or eradicate new invasive pests once detected. In addition, the state of California has just created the Invasive Species Council of California to provide a forum for six state agencies to coordinate their invasive species efforts.

AGRO 18
Detection of Huanglongbing in Florida citrus: Rapid responses and tapping the global knowledge base

J. W. Bell[1], john.bell@bayercropscience.com, D. Rogers[1], R. F. Morris II[2], R. D. Bagwell[1], L. S. Hall[1], and E. G. Ishida[3]. [1]Bayer CropScience, Research Triangle Park, NC, United States, [2]Bayer CropScience, Lakeland, FL, United States, [3]Bayer CropScience, Ventura, CA, United States

The introduction of an invasive pest requires immediate action and communication by all stakeholders to potentially eradicate or minimize the severity of spread. Considerable knowledge and experience with the pest, as well as associated management strategies, frequently exists outside of the introduction area that can be utilized and directly

applied to the invasive pest situation . The detection of Huanglongbing in Florida in August 2005 is a prime example, where federal and state governmental agencies, along with private institutions including Bayer CropScience, collected global knowledge and implemented measures in an effort to preserve the Florida citrus industry. The management of Huanglongbing requires a multi-tiered approach including both cultural and chemical-based measures; the Bayer CropScience products aldicarb, imidacloprid, carbaryl, and spirotetramat have proven to be powerful tools for protecting citrus budwood sources and nursery stock, as well as eliminating the vector on both immature and mature field plantings in Florida.

AGRO 19
Development and use of green chemistry insecticides and novel delivery systems for area wide control programs of invasive insects

L. E. Gomez, egomez2@dow.com, B. Bisabri, B. Bret, and D. L. Paroonagian. Department of Technical Experts on Insecticides, Dow AgroSciences, LLC, Indianapolis, IN, United States

Synthetic and naturally-derived products are a fundamental component of agricultural insect management programs. The development and registration of new active ingredients is a long, arduous, and very costly process. Area-wide quarantine and eradication programs for insect invaders often include agricultural and urban areas. In order to successfully implement area-wide control programs, it is necessary to optimize the use of current technologies as well as to utilize green chemistries and novel delivery systems for reduced human and environmental risks while maintaining high levels of control. Dow AgroSciences partnering with other public and private institutions has been working to provide breakthrough technologies using green chemistries for area-wide control of quarantine pests. This presentation will review some examples of those breakthrough technologies that are presently available or are anticipated to be available in the near future.

AGRO 20
Pesticides and the federal imported fire ant quarantine

C. L. Brown[1], Charles.L.Brown@aphis.usda.gov, and A.-M. Callcott[2]. [1]USDA APHIS PPQ Emergency Domestic Programs, Riverdale, MD, United States, [2]USDA APHIS PPQ Center for Plant Health Science and Technology, Gulfport, MS, United States

The U.S. Federal Imported Fire Ant (IFA) Quarantine Program, enacted in 1958 to prevent the artificial spread of this invasive species, is in need of efficacious chemicals. Currently all or parts of 14 States and Puerto Rico are under a federal IFA quarantine which often involves a chemical treatment of regulated articles (e.g. nursery stock such as containerized plants and grass sod) before they may be moved out of any quarantined area. Current IFA quarantine treatments rely heavily on turf and ornamental labels for two insecticides: chlorpyrifos and bifenthrin. As a result of EPA reregistration efforts, it has become increasingly difficult to retain registrations compatible with IFA Program needs. While research on developing further bifenthrin uses continues, options involving other active ingredients are needed. Registrations exist for other chemicals with properties essential for this quarantine (long-term, continuous residual activity in or on soil/potting media; the ability to penetrate dense root balls of various soil types; fumigants or aerosols to penetrate densely packed hay or pine straw bales; and products that repel IFA); however, these chemicals do not have the necessary turf and ornamental labeling and so are unavailable for IFA programs.

AGRO 21
A chemical history of gypsy moth management in North America

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The gypsy moth, *Lymantria dispar* (L.), is a forest defoliator that was introduced into North America in the late 1860's. Since then, the pest has been targeted repeatedly for eradication, containment, and simply reducing negative effects of outbreaks. Chemicals have played a central role in these efforts, and their use has largely mirrored the development of chemistry for insect pest management in general. Arsenical and cyanide insecticides in the 1800's and early 1900's were followed by chlorinated hydrocarbons such as DDT, carbamates, organophosphates, and modern products such as insect growth regulators and microbials. Current gypsy moth programs rely heavily on a sex-attractant pheromone, both for detecting and monitoring populations and for mating disruption, a non-toxic control tactic. The battleground against gypsy moth and other invasive pests is often urban or suburban, which presents a unique set of challenges, real and perceived, for ongoing and future use of chemicals.

AGRO 22
Collaborative research efforts in determining N_2O emissions from agricultural soils in California

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The California Global Warming Solutions Act of 2006, or AB 32, mandates reduction of statewide greenhouse gases (GHGs) emissions to the 1990 level by 2020. As part of the AB 32 initiative, California has put forward a research program, sponsored by California Air Resources Board (CARB), California Energy Commission (CEC), and California Department of Food and Agriculture (CDFA), to determine, through field measurements and modeling, the baseline N_2O emissions from California agricultural soils. Stakeholders, representing California growers, fertilizer industry, and federal, state, and local government agencies, participated in the research development. The projects will measure N_2O emissions in 10 cropping systems in Sacramento Valley, San Joaquin Valley, and Central Coast. With a combined fund >$1,000,000, the program is expected to produce robust field monitoring data and modeling tools for estimating N_2O soil emissions. Our ultimate goal is to identify and promote best management practices that can reduce agricultural N_2O emissions cost-effectively.

AGRO 23
Nitrous oxide emissions in response to nitrogen fertilization in lettuce production systems

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Lettuce production, which relies on intensive nitrogen (N) fertilization and frequent irrigation, can result in substantial nitrous oxide (N_2O) emissions. To develop best management practices that minimize these emissions without decreasing yield potential, accurate estimates of annual N_2O emissions from N fertilizer applications are needed. Nitrous oxide emissions are being assessed in a controlled 2-year field trial of subsurface drip-irrigated lettuce receiving N fertilizer at five rates ranging from 11 (control) to 340 kg N ha^{-1}. In all treatments, during the first cropping cycle, N_2O emissions were <1 kg N_2O-N ha^{-1} or <0.3% of the applied N, whereas yields were similar except for the control. In grower fields, N_2O fluxes varied greatly with the highest daily emissions reaching 0.7 kg N_2O-N ha^{-1}. Reduction of high N_2O emissions may be possible through adjustment of N fertilization rates after accounting for residual inorganic N.

AGRO 24
Climate impacts from agricultural emissions: Greenhouse species and aerosols

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Climate forcing is due to increases in greenhouse species such as carbon dioxide, nitrous oxide, methane, and aerosols. N2O and CH4 have connections to rice production. Primary emissions from agricultural burning are an important source of organic aerosols. Impacts of greenhouse species including aerosols will be overviewed. Recent work using carbon isotopic measurements (C-14/C-13) to source biogenic aerosols will be presented. Data from the Megacity Aerosol Experiment – Mexico City (MAX-Mex) show that agricultural burning can be a significant source of carbonaceous aerosols. Spectroscopic aerosol characterization have indicated that significant enhanced absorption can occur in the UV to IR from agricultural and forest burning and reactive volatile biogenic carbon emissions can form secondary organic matter. Use of natural isotopic carbon variations along with optical characterizations will be presented as a means of examining the impacts of agricultural burning practices for corn and sugar cane (C4-plants).

AGRO 25
Exchange fluxes of NO_x, N_2O, and NH_3 between two typical Chinese agricultural fields and the atmosphere

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Exchange fluxes of NO_x, N_2O and NH_3 between two typical Chinese agricultural fields and the atmosphere were investigated. The average fluxes (in units of ng N m^{-2} s^{-1}) of NO, NO_2 and NH_3 from winter wheat field in Yangtze Delta were 79, -5.62, and -5.1, respectively, and from paddy field were 3.7, -1.7, and 34.8, respectively. The fluxes of NO and N_2O from various vegetable lands in Yangtze Delta during a whole year investigation were in the range of 29.5-194.2 and 0.09-0.54 ng N m^{-2} s^{-1}, respectively. Compared with the Yangtze Delta, the fluxes of NO, N_2O and NH_3 from the agricultural field in Huabei district were remarkable, with average values (in units of ng N m^{-2} s^{-1}) of 94.4, 21.6-91.4 and 294, respectively. Distinct yearly variations of the fluxes were found, and hence, long-term field measurements are needed to reduce the uncertainties for the emission factors from agricultural fields.

AGRO 26
Challenges for developing GHG inventories for California crops: A case study of rice production

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For most U.S. agricultural crops, and California crops in particular, researchers are still developing baseline inventories for GHG emissions. Our recently completed GHG inventory of California rice production reveals important modeling challenges stemming from deficiencies in necessary data as well as variations in on-farm management practices. For example, field emissions of methane and nitrous oxide dominate the inventory, but existing data on methane emissions in California conditions are extremely variable and based on specific management practices, while nitrous oxide emissions had to be estimated from foreign studies. Current data limitations do not yet allow for a model that dynamically links emissions to the myriad of field management and fertilizer application choices available to California rice producers. These limitations mean that the current inventory for rice production is specific to a region and production process. Future work requires developing the linkages between practices, climate and emissions in order to achieve the full potential for reducing greenhouse gas emissions from agricultural crops.

AGRO 27
Large decline in fertilizer-induced direct N_2O emission estimates from Chinese intensive agriculture by minimizing both errors and nitrification of NH_4^+-based fertilizer

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There is great uncertainty about the contribution of fertilizer-induced direct N_2O emissions from Chinese intensive agriculture to global anthropogenic N_2O emissions. Here we provide new evidence that Chinese emissions were previously overestimated using either no cropping-specific emission factors (EF) or EF derived from low frequency measurements. Among three main crops, N_2O emissions from paddy rice had an EF near the default value (0.3 %), wheat and maize had a much lower EF than the IPCC2006 default (1 %) for upland crops. These low N_2O emissions and EF values are attributed to low denitrification rates due to limited readily oxidizable C and soil moisture despite consistently high soil nitrate-N concentrations. N_2O emissions occurred mostly within two weeks of NH_4^+-based fertilizer N application, with nitrification the main process responsible. However, we still lack knowledge to estimate indirect N_2O emissions during the off-field N flow associated with large N losses from agricultural fields.

AGRO 28
Alternative rice flood management effects on methane and nitrous oxide emission

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Rice production systems are intensively managed wetlands that can be significant sources of greenhouse gases. Methane emissions can be lowered through changes in water level or periodicity of flooding. However, wet-dry regimes can lead to denitrification and increased nitrous oxide emission. We examined the effect of seeding method (aerial vs. drill), in-season drain and reflood and late-season flooding on methane and nitrous oxide emission. Nitrous oxide emission was less than 1% of added fertilizer N regardless of water management or seeding method. Methane production was significantly greater in the continuous and in-season drain treatments with greater than 0.35t CH_4-C ha^{-1} y^{-1} emitted. The midseason flood treatment resulted in significantly lower methane emission (0.25t ha^{-1} y^{-1}). However, the midseason flood treatment yielded significantly lower (10%). Water savings and participation in carbon trading markets could make the late flood treatment more viable as a rice production practice.

AGRO 29
Withdrawn

AGRO 30
Role of micro-irrigation systems on greenhouse gas emissions from California perennial crops systems

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Perennial crops orchards and vineyards represent grid based assemblages of trees and vines where water and N fertilizer applications occur in regular patterns. This assemblage is overlaid upon extremely heterogeneous soils that change abruptly at a scale that occurs within individual orchards and vineyards. Using measurement transects and 2-dimensional modeling approaches, we were able to constrain emissions of nitrous oxide (N_2O) to a fertirrigated area of less than 1 square meter. The third dimensional component of fertilizer derived N_2O emissions (time) appears to occur generally within a timeframe of 36 to 48 h when drip or microjet spray irrigation systems are utilized. Soil physical properties at the within vineyard/orchard landscape contributed to a nearly 3-fold variation in emissions which was attributed to drainage. Our results indicated that layered complexity within vineyards and orchards may greatly challenge our ability to constrain annual emissions of greenhouse gases from perennial crops.

AGRO 31
Volatile organic compound analysis of vermicompost from pachyderm manure by GC-MS

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Vermicompost is widely used technique to produce organic fertilizer. However, the use of manure for composting produce metane, carbon dioxide and other volatile organic compounds (VOC) that could kill earthworms and contribute to greenhouse effect. This study will monitor the amounts of VOC during the process of vermicompost from the beginning to the final process a month later. Gas chromatography mass spectrometry (GC-MS) is the most common technique for VOC analysis. Gas samples were analyzed by headspace and detected the presence methane (m/z at 16) in the fresh manure, but drastically levels lower after one day. At low levels and under a stable temperature and humid environment, earthworms worked the best. Carbon dioxide (m/z at 44) was detected in the column around one minute later after methane, but nitrogen purge of the samples will be required. Other VOC will be analyzed. Results were used to determine the best moment to begin vermicomposing. Effect on the greenhouse gases amounts will be consider statistically.

AGRO 32
OECD harmonization of terrestrial field dissipation guideline and ecoregion crosswalk

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The U.S. Environmental Protection Agency (EPA) and Canada's Pest Management Regulatory Agency (PMRA) are leading an effort to harmonize the NAFTA guidance for conducting terrestrial field dissipation (TFD) studies with Europe and to develop an ecoregion crosswalk across North America and Europe. The TFD studies assess the transformation, transport, and fate of pesticides under representative actual use conditions. The major objective of the ecoregion crosswalk project is to develop a crosswalk for North American and European field study sites and to determine if studies conducted at a specific site in North America or Europe can be used across international borders based on the similarity of the ecoregions in North America and Europe. US-EPA has the lead for harmonization of the guidance for terrestrial field dissipation studies, while PMRA-Canada has the lead for developing the ecoregion crosswalk component. This presentation will focus on harmonizing NAFTA guidance for terrestrial field dissipation studies and initial efforts to identify and compare European TFD guidance with North American guidance. This comparison includes an evaluation of study design parameters, triggers for requesting data, and use of data generated from these studies in ecological risk assessments.

AGRO 33
Comparison of European field soil dissipation studies to NAFTA and international use environments: Soil and climatic conditions

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Registration of crop protection products requires environmental fate data including field dissipation studies that usually must be conducted in specific countries to meet regional data requirements. The development of global regulatory reviews offers the opportunity for submission of studies conducted in one region for consideration as part of a global database. The environmental fate package for a new development compound included European field dissipation studies. A comparison of soils, climate, and moisture regimes of existing European studies to proposed NAFTA (US and Canadian) use areas was carried out to identify potential gaps in the field study database. Soil properties (order), annual average precipitation and air temperature from long-term average data were used in this comparison based on

the general NAFTA field dissipation site selection guidance. Spatial data processing and thematic mapping were accomplished using ArcGIS 9.2. Recent national agricultural statistical censuses of each country were selected. Cropping statistics were reported at the county administrative unit in the United States and at the Census Agricultural Region unit in Canada. Criteria were established to show areas within the NAFTA countries that are anticipated to experience similar weather conditions to the EU study locations and account for the anticipated yearly variation. The soil and weather conditions represented by the European studies are analogous to many of the target use areas in the United States and Canada and correspond to ecoregions that exist in both countries, a criterion for acceptance of studies by Canadian regulatory authorities.

AGRO 34
Terrestrial field dissipation (TFD) study design and utility of data for California conditions

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The U.S. EPA TFD guideline indicates that application of water should reflect 110% of historic crop water demand. Irrigation methods with an inherent potential to produce large amounts of percolating water, such as furrow irrigation, are still used on crops grown in coarse-textured soils where water applications are at around 160% of crop water demand. Results from a study of irrigation method and amount of water applied in a coarse soil provided a positive correlation between the amount of percolating water produced and extent of leaching, indicating that greater efficiency of water application concurrently reduces the amount of water and atrazine leached below 1 meter. Lack of production of percolating water in many studies limits application of the data in estimates of potential leaching in CA. A modeling approach has been developed in order to bridge this gap for data that directly measures leaching. This talk describes the framework for the development of the modeling approach and its application to the analysis of the potential for a new active ingredient or new use of an active ingredient to contaminate ground water. Since many TFD studies are conducted outside of CA, additional studies in CA may be required. If additional studies are conducted in CA, adherence to the U.S. EPA TFD study design is acceptable but modification of the water application treatments are necessary whereby one treatment is designated at 160% of evaporative demand, which reflects a potential leaching scenario, and another at 125%, which reflects an efficiently managed irrigation system.

AGRO 35
Results from terrestrial field dissipation studies conducted according to harmonized NAFTA guidance

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Under the North American Free Trade Agreement (NAFTA), the U.S. Environmental Protection Agency (EPA) and Canada's Pest Management Regulatory Agency (PMRA) agreed to harmonize their testing guidance for conducting terrestrial field dissipation (TFD) studies in March 2006. TFD studies are conducted to demonstrate the transformation, transport, and fate of pesticides under actual use conditions. While laboratory environmental fate studies address one dissipation process at a time, TFD studies address pesticide loss as a combined result of chemical and biological processes and physical migration. The NAFTA guidance document is based on a conceptual model that defines the fate and transport of pesticides in several environmental compartments (air, soil, surface water, ground water). As such, this guidance can help the risk assessor determine which compartment (or module) should be the primary focus of the terrestrial field study. The modules of the TFD guidance are identified on the basis of pesticide properties, formulation types, and actual use patterns. In this presentation, the authors will evaluate studies that were conducted according to the NAFTA harmonized guidelines and discuss whether these studies provided the results outlined in the conceptual model approach of the NATFA harmonized guidance.

AGRO 36
Comparison of European field dissipation studies to NAFTA and international use environments: Study design and dissipation rate data

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Picoxystrobin, a broad spectrum strobilurin type fungicide, is registered in many countries. The environmental fate package includes European and NAFTA field dissipation studies. A comparison of the study designs and results obtained from both sets of studies will be presented. While there were differences in the design of the studies, there was no significant difference between the results of the European studies and the North American studies. There was no obvious indication of a relationship between the estimated dissipation rates and measured soil properties. Because of the rapid dissipation rate, which is comparable to the laboratory degradation rate, and the similar application timing, differences in annual mean temperature do not have a marked effect on the dissipation rates. The data from the European studies allow prediction of expected environmental fate behavior in North America and provide acceptable results for meeting NAFTA data requirements. Conclusions from this comparison support on-going efforts to develop an "ecoregion crosswalk" for North America and Europe.

AGRO 37
Utilization of registrant-supplied data for probabilistic modeling of pesticide movement to California ground water

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The California Department of Pesticide Regulation (DPR) is responsible for the registration of pesticides in California. DPR's Environmental Monitoring Branch evaluates the potential for pesticide active ingredients, submitted for registration, to move to ground water under agricultural use conditions. Previous evaluations were primarily based on threshold values for specific persistence and mobility properties of pesticides as prescribed in the California Pesticide Contamination Prevention Act of 1985. Two limitations identified with that process were the univariate nature where interactions of the properties were not accounted for, and the inability to accommodate multiple values of a physical-chemical property. Furthermore, pesticide terrestrial field dissipation data supplied by registrants are often unrepresentative of the product's persistence and movement in the soil under California conditions where irrigation is the predominant source of crop water. These limitations were addressed by developing a probabilistic modeling method based on prediction of well water concentrations where typical levels of percolating water are simulated. A mechanistic pesticide transport model is used to simulate sorption, degradation and

transport of a candidate pesticide through the root zone. A second empirical model component then simulates pesticide degradation and transport through the vadose zone to a receiving ground water aquifer and finally to a well where concentrations are compared to a threshold value. Much of the data utilized in the modeling process are derived from registrant supported studies. Where data are lacking for sensitive modeling parameters, simple distributional functions are developed from the available data for use in a probabilistic modeling procedure.

AGRO 38
Screening approaches for predicting pesticide concentrations in groundwater

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The U.S. Environmental Protection Agency's Office of Pesticide Programs (USEPA-OPP) has been using two modeling approaches to estimate pesticide exposure in ground water. SCIGROW is an empirical model derived from the results of controlled, field-scale groundwater monitoring studies. PRZM GW is a graphical user interface that automates the Pesticide Root Zone Model (PRZM) under a NAFTA-harmonized conceptual model. A third approach presented herein links PRZMS to an aquifer dispersion and advection model (ADAM) based n Darcy's law to estimate concentrations in ground water. The methodology and the ability of all three approaches to reproduce the results of several groundwater monitoring studies are compared.

AGRO 39
Infrared heating as a pasteurization method for almonds

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The almond pasteurization plan became mandatory for the California almond industry on September 1, 2007 and now all almonds must be pasteurized before being sold to consumers in North America. The FDA has approved oil roasting, dry roasting, blanching, steam processing and propylene oxide (PPO) processes as acceptable forms of pasteurization for almonds. However, there is a great need in developing dry pasteurization methods for raw and roasted almonds. With the support from the Almond Board of California, we have studied various approaches of using infrared heating for raw almond pasteurization and almond roasting. As a result, the required 5-log reduction of pathogens on raw almond kernels was achieved using fast infrared heating to a temperature above 100 degree C and followed by cooling and holding at a temperature above 70 degree C for a certain period of time. The infrared pasteurized raw almonds still maintained raw almond characteristics. When sequential infrared heating and hot air roasting was used for almond roasting, the pathogen reduction was significantly improved and met the pasteurization requirement compared to conventional hot air roasting.

AGRO 40
Detecting prions: Discriminating isoforms in the attomole range

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Transmissible spongiform encephalopathies (prion diseases)are characterized by a long asymptomatic incubation period followed by a short disease course ending in death. Prions persist in the environment and are resistant to conventional forms of inactivation, such as heating, autoclaving or exposure to formaldehyde. The incubation period of a prion disease often exceeds the economic lifetime of agriculturally important animals. Since the incubation period of a prion disease is inversely proportional to the titer of the disease, there is no "safe" dose of prions. Detecting prion diseases as early as possible is essential to preventing their spread. We have developed a mass spectrometry-based method of detecting prions in presymptomatic animals. We empirically identified a trypsin cleavage peptide (VVEQMCTTQYQK) that ionizes well and permits us to quantify prions in the attomole (10 exp -18 moles) range. This approach permits the simultaneous identification and quantitation of prions.

AGRO 41
Review of anticarcinogenic and anticholesterol effects of the tomato glycoalkaloid tomatine

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In collaborative studies, we used a microculture tetrazolium (MTT) *in vitro* cell assay to screen 17 potato, tomato, and eggplant glycoalkaloids and metabolites (hydrolysis products) for inhibitory effects against human cancer cells. The tomato glycoalkaloid tomatine (a ~10:1 mixture of α-tomatine and dehydrotomatine which is reported to protect the plant against phytopathogenic fungi, bacteria, and viruses) was found to be a strong inhibitor of growth for both human colon and liver cancer cell lines. We also found that feeding commercial tomatine and the multi-organ carcinogen dibenzo[*a,l*]pyrene (DBP) to rainbow trout for 9 months resulted in a reduced incidence of liver and stomach tumors as compared to the incidence of tumors observed with DBP alone. The tomatine-containing diets did not induce changes in mortality, fish weights, liver weights, or in tissue morphology. No adverse pathological effects in the tissues of the fish on the tomatine diets were observed. In another study, we found that (a) tomatine-rich green tomato extracts also inhibited the growth of human cancer cell lines; (b) pure α-tomatine isolated by preparative HPLC from green tomatoes was highly active against four cancer cell lines; (c) isolated dehydrotomatine (whose structure differs from α-tomatine only by the presence of a double bond in ring B) exhibited low activities against all cell lines; and (d) the respective aglycones tomatidine and tomatidenol showed moderate activity against some of the cell lines. Cell growth inhibition correlated with tomatine content of the tomato extracts. These observations complement our reported findings that orally fed tomatine and green tomato powders reduced plasma cholesterol and triglyceride levels in hamsters. Possible mechanisms and the significance of the dual beneficial *in vitro* and *in vivo* effects of pure tomatine and of tomatine-rich extracts and freeze-dried powders for plant physiology and the diet will be discussed.

AGRO 42
Mitigating risks of foodborne pathogens by processing intervention technologies

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Foods are contaminated by microbial pathogens from the soil, air, fertilizer, animal and human contacts. Many foodborne pathogens are capable of surviving the washing, storage and distribution; causing foodborne illness outbreaks. We can mitigate the risk of foodborne pathogens by producing foods without contamination, by detecting contamination and discarding contaminated products, and by processing the products to kill or remove the pathogens. It is currently not practical to either grow sterile foods or detect sporadic contamination. Process intervention technologies are used to ensure the safety of food supplies. While many food products can be sterilized by cooking or the retort process, fresh produce, sea food, and fruit juices would not tolerate the extent of thermal processing. Nonthermal processing technologies are being developed to maintain the quality while ensuring the safety. This presentation will provide an over view of nonthermal processing technologies and their suitability as food safety interventions.

AGRO 43
FDA applications of field portable XRF for consumer product analysis: Cl to U down to low ppm levels in 60 seconds or less

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XRF analyzers are being increasingly employed by the FDA for a number of regulatory applications. While XRF does not have the detection limits of ICP-MS, it has a number of characteristics that make it the method of choice for certain applications. In the field, XRF can be used to rapidly screen large numbers of products to identify potential samples of concern. In the lab, XRF requires minimal sample preparation other than homogenization (thus obviating the need for sample digestion and filtration), and can provide accurate and reliable quantitative results when calibrated properly and used by a trained analyst. This presentation will describe the use of XRF for both screening and accurate quantitative analysis of leachable elements in tableware and toxic elements in supplements. Its use in rapidly differentiating between fake and authentic drugs based on their elemental composition profiles will also be described.

AGRO 44
Status and future of herbicide use for controlling invasive aquatic plants

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Over the past 20 years major changes and improvements in chemical control strategies for managing nuisance aquatic vegetation have occurred. However, invasive plants continue to spread and remain a concern for resource managers on a national scale. The registration of the bleaching herbicide, fluridone, in the 1980s for large-scale management stimulated research involving reduction of rates, plant selectivity, residue monitoring, and impacts on fisheries. In addition, the specificity of fluridone for a single plant enzyme led to the first documented case of herbicide resistance in aquatic plant management. Resistance of hydrilla to fluridone has fostered a renewed interest by industry and others in the registration of alternative modes of action for aquatic use. These newer chemistries are enzyme-specific compounds with favorable non-target toxicity profiles. Registration efforts have been facilitated by increased cooperation between key federal government agencies that have aquatic weed control and research responsibilities, and regulators within the US Environmental Protection Agency. Future research directions in chemical control include improving methods for evaluating non-target impacts emphasizing threatened and endangered species; improving herbicide performance in flowing-water environments; developing herbicides for large-scale management approaches; increasing cooperative work with ecologists to evaluate long-term impacts of invasive species and herbicide programs on native plant assemblages, water quality, and fisheries; and improving integration of chemical control with other aquatic plant management disciplines.

AGRO 45
Working within the U.S. regulatory framework to address invasive vertebrate pest issues

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Invasive vertebrate species in the USA can be traced to the arrival of European explorers with the intentional introduction of livestock and sport animals, and the unintentional introduction of rats and other stowaways. Dozens of invasive vertebrate species and their impacts to human health and resources and ecological environments have been recognized. USDA APHIS Wildlife Services' direct control efforts of invasive vertebrates involve current and emerging threats to agriculture, natural resource, human health and safety. We examine chemical control methods used by Wildlife Services to manage problems caused by the invasive rodents, wild pigs, starlings and pigeons, and brown treesnakes. The use of chemical solutions requires significant interaction with regulatory agencies to ensure proposed solutions are legal and present insignificant risk to humans and the natural environment. We examine interactions with regulatory authorities that have worked well and regulatory oversight areas that limit rapid response to emerging problems.

AGRO 46
Chemical management for controlling invasive frogs in Hawaii

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In Hawaii the coqui frog, *Eleutherodactylus coqui,* has become an invasive pest. Since their introduction late 1980s, coqui frog populations have spread throughout the Hawaiian Islands and are extremely dense in some areas with 91,000 frogs /ha. Calls of male frogs may exceed 90 dB so people are reluctant to purchase frog infested products. Thus, frogs have affected the nursery industry through reduced sales and increased costs for frog control. Chemical control has been an affective method to control coqui frogs. We have screened over 90 chemicals agents (agricultural pesticides, pharmaceutical and household products) and 155 chemical formulations as potential dermal frog toxicants. Only 11 chemicals have showed high frog mortalities of (>80%) and since 2001 only 3 chemical agents (caffeine, citric acid and hydrated lime) have been approved for frog control. Currently citric acid is the only legally chemical considered safe for the environment and effective for controlling frogs.

AGRO 47
Available US EPA tools to address invasive pests

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The mission of EPA's Office of Pesticide Programs (OPP) is to protect public health and the environment by ensuring that pesticides and their alternatives are safe and available for a healthy America. Under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), the Agency has several vehicles in which we may provide communities with pesticide tools to address the threat of invasive species. The Agency must, however, conduct risk assessments for these tools under the regulations of the Federal Food, Drug and Cosmetic Act, as well as under FIFRA, to ensure that they can be used in a safe and efficacious manner. Recent actions by OPP to address various invasive species have included registration decisions on FIFRA Section 3 registrations, State-issued Special Local Needs Registrations and Emergency Exemptions.

AGRO 48
Current use and future needs of semiochemical lures for California's detection and control programs

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The California Department of Food and Agriculture (CDFA) operates approximately 210,000 insect traps statewide to detect invasive species. A number of different pheromone, parapheromone, and food-based semiochemical lures are used. In addition, a limited number of lures are combined with insecticides to provide control options. The use of these semiochemical lures has enabled the CDFA to prevent the permanent establishment of a number of serious invasive pests, such as exotic fruit flies, gypsy moth, and Japanese beetle. The CDFA is constantly looking for improvements to these lures, as well as for new lures for a wide range of invasive insects for which there are no lures currently available, such as glassywinged sharpshooter and Asian citrus psyllid.

AGRO 49
Minor significance or major problem?

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Besides the high profile pests that are considered continuously actionable by the USDA and CDFA, such as exotic fruit flies, there are many species that have entered the US in the past 15 years and have become established. This talk will review the pests that have become established in landscapes and agriculture where quarantine efforts have been discontinued or never taken. Often these pests require action by homeowners and small growers without significant research being conducted to backup methods of control. These non-actionable pests represent an opportunity for research on new and existing chemistries.

AGRO 50
Questioning assumptions regarding soil nitrous oxide emissions and fertilizer use

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Agricultural fertilization worldwide reportedly contributes 6.2 Tg N_2O-N yr^{-1} to a total global source strength of 17.7 Tg N_2O-N yr^{-1}, and it is not entirely clear how fertilizers influence the net flux of N_2O from soils. Data are lacking in agriculturally productive areas of the upper Midwestern United States, where sub-zero soil temperatures persist over a prolonged winter. Here, several questions are addressed:
(1) Is soil biology truly quiescent in winter, such that fertilization before freeze-up does not affect in N_2O emissions?
(2) Does denitrification of N to N_2 and N_2O occur at sub-zero soil temperatures?
(3) Does soil temperature at the time of fertilization affect N_2O emissions?
(4) Do "precision" agricultural practices lower N_2O emissions and increase yields?
(5) Do increasing doses of fertilizer-N result in greater emissions of N_2O?
(6) Do agronomic rates of urea-N application to crops enhance N_2O emissions at a field scale?

AGRO 51
Nitrogen source effects on nitrous oxide emissions from irrigated cropping systems

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Nitrous oxide emissions were monitored from irrigated systems receiving different N sources (0 to 246 kg N ha^{-1}). Nitrous oxide fluxes were measured weekly using static, vented chambers and gas chromatograph analyzer. Cumulative growing season N_2O emissions from urea and a controlled-release, polymer-coated urea (ESN®) application were not different under conventional-till continuous corn, but were different under no-till continuous corn, where ESN® reduced N_2O emissions 49% compared to urea. A stabilized urea (SuperU®) reduced N_2O emissions 27% in a 2007 dry bean crop and 54% in a 2008 corn crop in a NT corn-dry bean rotation. SuperU® reduced N_2O emissions 19% in a 2007 barley crop and 51% in a 2008 corn crop compared to urea in a NT corn-barley rotation. Other N sources will also be discussed. Current tillage and fertilizer N technologies that delay release and transformation of N can substantially reduce N_2O emissions under specific cropping conditions.

AGRO 52
Urea fertilizer decreases N_2O emissions by 50% compared with anhydrous ammonia in corn/soybean cropping systems in Minnesota

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Quantifying N_2O emissions from corn and soybean fields is essential to developing greenhouse gas inventories. This study compared N_2O emissions in plots managed under continuous corn (C/C) and corn-soybean (C/S) rotation that were fertilized during the corn-phase with either anhydrous ammonia (AA) or urea (U). Over three growing seasons, N_2O emissions from corn following corn were nearly identical to corn following soybean. However, in both systems, N_2O emissions with AA were twice the emissions with U. It was estimated that a shift from C/S to C/C would result in an

increase in emissions of 0.78 kg N ha^{-1} y^{-1} (equivalent to 0.11 Mg CO_2-C ha^{-1} y^{-1}) when AA was used, compared to only 0.21 kg N ha^{-1} y^{-1} (0.03 Mg CO_2-C ha^{-1} y^{-1}) with U. In light of trends toward increased use of U, these results suggest that fertilizer-induced soil N_2O emissions may decline in the future.

AGRO 53
Greenhouse gas emissions in conventional and alternative cropping systems of California's Central Valley

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Despite the importance of agriculture in California's Central Valley, the potential of alternative management practices to reduce soil greenhouse gas (GHG) emissions has been poorly studied in California. Here, we will present results from (1) intensive event-related N_2O measurements in conventional and alternative cropping systems (2) the calibration and validation of DAYCENT, an ecosystem model, for conventional and alternative cropping systems (2) model simulations of CO_2, N_2O and CH_4 soil fluxes from these systems. The alternative practices considered were cover cropping, organic practices, conservation tillage, and biochar amendment. These practices were compared with conventional agricultural management. Both field crops (i.e., beans, corn, cotton, safflower, sunflower, tomato, lettuce and wheat) and perennial crops (i.e., wine grapes and alfalfa) were considered. Event-related N_2O measurements were conducted in a vineyard and a lettuce system with biochar amendments. Fluxes of N_2O were drastically increased after chemical fertilizer application, cover crop incorporation, and significant rain or irrigation events, but were reduced by biochar amendment. Four field sites for which at least five years of measured data were available, were used to calibrate and validate the DAYCENT model. The model was able to predict 86% to 94% of the measured variation in crop yields and 69% to 87% of the measured variation in soil organic carbon (SOC) contents. Conservation tillage had the smallest potential to reduce GHG emissions among the alternative practices evaluated, with a significant reduction of 336 ± 47 to 550 ± 123 kg CO_2-eq ha^{-1} yr^{-1}. Cover cropping had a larger potential, with net soil GHG flux reductions of 752 ± 10, 1072 ± 272 and 2201 ± 82 kg CO_2-eq ha^{-1} yr^{-1} at three sites. Organic practices had the greatest potential for soil GHG flux reduction, with 4577 ± 272 kg CO_2-eq ha^{-1} yr^{-1}.

AGRO 54
Process based models for quantifying nitrous oxide emissions: Calibration, validation and application of DNDC model in California cropping systems

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If agricultural GHG offset projects are to include N_2O reductions, then process-based biogeochemical models are going to be an integral part of protocol and project development. While there have been many validation efforts in the past, they have been done in an *ad hoc* fashion and with a goal of validating the model performance for a single site. Intensive and extensive validation exercises are needed to statistically quantify uncertainties in model based estimates of both baseline and project based GHG emissions. In addition to providing critical documentation of model performance and statistically valid uncertainty metrics, this validation work can help guide development of offset protocols and improve modeling science. This paper will present**:** (1) brief overview of the DNDC model, (2) current efforts for calibrating and validation DNDC for modeling nitrous oxide emissions from agroecosystems of California; and (3) critical data gaps for improving DNDC application for carbon offset protocols.

AGRO 55
Soil nitrogen cycling and GHG accounting methodologies

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Nitrous oxide (N_2O) is the primary greenhouse gas associated with most non-flooded cropping systems. N_2O emissions have been measured from numerous experimental plots around the world and the resulting data have led to the development of various models. The USA uses process based models to estimate soil GHG fluxes from agricultural lands while most other nations use simpler models. Comparing N_2O fluxes estimated by different methods shows that as scale decreases, complex models usually agree more closely with measurements than simple models. At the farm level, complex models appear to be the best method to estimate emissions because measuring is too expensive and simple models are not reliable at this scale. Because about half of the N fertilizer added to soils is lost from the plant/soil system, there is potential to reduce N_2O emissions. Different methodologies used to estimate GHG emissions and mitigation potentials will be compared.

AGRO 56
COMET-VR: Decision support system for agricultural greenhouse gas accounting

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Measurement, monitoring and verification (MMV) are essential requirements for the implementation of agricultural greenhouse gas mitigation practices. COMET-VR is a user-friendly web-based tool that provides estimates of net greenhouse gas emissions at the field scale for MMV. It links a large set of spatial and non-spatial databases of environmental and management factors to several empirical and process-based models. The system provides mean estimates and uncertainty for CO_2 emissions and removals from woody biomass and soils and soil N_2O emissions for cropland, grassland, perennial woody crops (orchards, vineyards), agroforestry practices, and fossil fuel usage. Examples of model application for a diverse suite of land conservation practices are presented. Ongoing work to incorporate remote sensing data to improve field-level estimates of plant production and C inputs to soil and to develop a national-scale soil monitoring network to reduce model uncertainties are discussed.

AGRO 57
Role of nutrient management in reduction of greenhouse gases

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Food, fiber, and fuel demands of a growing global population are resulting in increased fertilizer nitrogen use. Correct N management decisions, based on agronomic and environmental research, can improve crop production and help reduce GHG emissions. Residual soil nitrate and

emissions of N_2O may be minimized when best management practices for fertilizer N are implemented. Balanced fertilization with other essential nutrients also enhances N use efficiency. Emissions of N_2O vary among fertilizer N sources, depending on cropping conditions. With intensive crop management, GHG emissions are not necessarily increased per unit of production. Such ecological intensification of crop production can help spare natural areas from conversion to cropland and preserve lands for GHG mitigation. Use of the right source, at the right rate, right time, and right place – termed 4R Nutrient Stewardship - is advocated, in combination with appropriate cropping and tillage practices, to achieve agronomic, economic, and environmental goals.

AGRO 58
Carbon footprints and turf management: Carbon emissions and sequestration for golf courses

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Regardless of uncertainties in global warming climate modeling, carbon footprint reduction is a good thing: it helps reduce our overall ecological footprint, and it works toward the goal of energy independence. Golf course facilities provide many opportunities to reduce C emissions and increase C sequestration. Pesticides and fertilizer production emits C, and these products are used on >>99% of all US golf courses. Substitution of 'natural'/'organic' fertilizers for some of the synthetic products is an option that results in reduced C emissions. Some data on C emissions for pesticide production are available, but more are needed. The greatest source of golf course C *emissions* is electricity use due to the clubhouse>maintenance facility>irrigation/well pumps. C *sequestration* is significant, and declines in the order trees>shrubs>greens/tees/fairways>native grasslands. Golf course facilities, including the clubhouses, seem to be net significant carbon emitters, but the golf courses themselves seem to be close to carbon neutral, and may achieve net sequestration. Many opportunities exist for improving their C footprints.

AGRO 59
Discovery of imidacloprid and afterward development: View from strategic molecular design

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Imidacloprid, current top-selling insecticide, was first prepared in 1985. Discovery of the pioneer compound prompted the afterward developments of neonicotinoid class agents which account for nearly 20% of the world insecticide market. The lecture trails the way starting from nithiazine as the lead to reach imidacloprid, mentioning another neonicotinoid thiacloprid and a rice-blast fungicide carpropamid that were prepared by this author. The models for neonicotinoid-receptor interaction were deduced from the crystallographic analysis of neonicotinoid molecules. The QSAR study on the key pharmacophore not only supports the predicted model but also clarifies the crucial involvement of the pharmacokinetic factors of a molecule in the insecticidal action. Extensive studies in molecular designs achieved highly insecticidal molecules by introducing substituents to the pyridine ring and azido-bearing photoaffinity probes. A concept for strategic and rational design of unique molecules led to discovery of alkylene-tethered bis-imidacloprid derivatives, providing unexpected plant-mobile (systemic) insecticidal behavior.

AGRO 60
Overview on the status and global strategy for neonicotinoids

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Neonicotinoids have been the fastest-growing class of insecticides in modern crop protection, with widespread use against sucking and certain chewing pests. As potent agonists, neonicotinoids act selectively on insect nicotinic acetylcholine receptors (*n*AChRs). Their discovery can be considered as a milestone in insecticide research and facilitates the understanding of functional properties of the insect *n*AChRs. In this context, the acetylcholine-binding protein structure provides the theoretical foundation for designing homology models of the receptor ligand binding domains within the *n*AChRs - a useful basis for screening and rational design of novel insecticides. Because of the low risk for non-target organisms and environment, the high target-specificity and their versatility in application methods, neonicotinoids have to be maintained globally for integrated pest management strategies and insect resistance management programmes. Innovative concepts for life-cycle management, jointly with introduction of generic products, will, within the next few years, turn neonicotinoids into the most important chemical class for the insecticide market.

AGRO 61
Importance of physicochemical properties for design of new pesticides

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Physicochemical properties of candidate compounds play important roles for design of new pesticides. Pesticides must be absorbed into pests, be transported to the target site, and then interact with proteins. Hydrophobicity is very important for these processes. Log P, where P is the partition coefficient in the 1-octanol/water system is commonly used as a hydrophobic descriptor and correlates with membrane permeation, transport, etc. Recently we reported permeability by the parallel artificial membrane permeation assay (PAMPA) could be used for prediction of human oral absorption of passively-transported compounds. PAMPA, which is a rapid high-throughput screening system, may be useful for prediction of pesticide absorption even if PAMPA permeability can be calculated using log P and other parameters. Electronic and structural properties as well as hydrophobicity are important factors for protein-ligand interaction. As an example, the 3-dimensional quantitative structure-activity relationship for binding affinities of imidacloprid related compounds is presented.

AGRO 62
Distribution and development of neonicotinoid resistance

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The commercial development of neonicotinoid insecticides, heralded by the discovery of imidacloprid, has been a huge landmark in the history of insect pest management. However, as with all versatile and widely-used chemical

groups, concerns have been raised about risks of resistance in target pests. Such fears have so far been realised in a small number of pest species, most notably whiteflies (*Aleyrodidae*) and planthoppers (*Delphacidae*). Analysis of these outbreaks have produced valuable data on the inheritance and phenotypic expression of resistance, prospects for cross-resistance within neonicotinoids and to other insecticide groups, and the molecular mechanisms capable of conferring protection in the field. Research on pests (e.g., *Aphididae*) that are still well controlled by neonicotinoids also provides important information on sustainable use and product deployment . Against a backdrop of continuing expansion and diversification of neonicotinoid chemistry, this presentation will review lessons learnt and challenges for the future.

AGRO 63
Neonicotinoid metabolism in insects relative to mechanism-based resistance

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Neonicotinoid insecticides account for more than 15% of the total global insecticide market, and are especially registered for agricultural use against many of the worlds most devastating pest insects such as whiteflies, aphids, hoppers and Colorado potato beetles. Whereas many sucking pests and beetle species are well-controlled by neonicotinoids, many lepidopterans such as noctuid pests are usually not affected, although compounds such as imidacloprid bind with nanomolar affinity to their nicotinic acetylcholine receptors, but are metabolized and sequestered rather quickly after uptake. Those pest insects susceptible to neonicotinoids but considered as high-risk pests concerning resistance development evolved particularly monooxygenase-based detoxification mechanisms due to continuous selection pressure, e.g. the cotton whitefly, *Bemisia tabaci*. The paper describes the pharmacokinetic and toxicodynamic behaviour, as well as the evolution and status of mechanism-based neonicotinoid (cross)resistance in different insect pest species.

AGRO 64
Neonicotinoid metabolism: Compounds, substituents, enzymes, and relevance

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The seven commercial neonicotinoids have a large number and great variety of substituents and in their use they are exposed to mammals, insects, plants, and other organisms. Most information is available on metabolism in mammals and plants to meet the requirements for registration and establishing tolerances. Knowledge of their metabolism is used to evaluate selective toxicity, persistence, residues, and safety. Other studies consider comparative metabolism in tolerant and susceptible pest strains. The balance of substituents, enzymes, locale, and exposure time govern the metabolism rate and pathway. Early studies investigated individual compounds in many environments but more recently several neonicotinoids have been compared in the same biological system. Synergism factors by CYP450 inhibitors help define biodegradable substituents in structure-activity studies. Enzymes found to metabolize neonicotinoids are used for structure-biodegradability investigations. Bioactive metabolites are of particular interest and concern. This review focuses on neonicotinoid substituent effects on biodegradability, persistence, and toxicology.

AGRO 65
Challenges of creating a change continuum in the agricultural community: From resistance to adoption of environmental mitigations on the Central Coast of California

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Current literature cites pesticide and nutrient discharges related to agricultural production as a major source of water quality impairment in the U.S. The Central Coast Agricultural Water Quality Coalition in a grower-driven, non-profit organization which assists California Central Coast growers with water quality issues through cooperative problem solving. This presentation will discuss difficulties encountered when developing environmental mitigations, such as Landguard and PAM, for adoption by commercial agriculture. Challenges consist of engaging disparate interests: agronomic, environmental, technical, cultural, and educational. Regulation and market-driven factors also impact the change continuum from resistance to adoption of mitigation technologies. Two case studies will be presented. One will illustrate a project demonstration-based approach that encouraged behavior change. The second case study will demonstrate a watershed-based approach which utilized confidential, end-of-field sampling to provide educational verification of the efficacy of multiple BMPs. Project challenges and outcomes will be discussed.

AGRO 66
Relating agrochemical fate with conservation practices in the Choptank River watershed

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The Chesapeake Bay is the largest estuary in the US and spans 167,000 km^2. The Choptank River is an estuary and tributary on the eastern shore of the Chesapeake Bay located within the Mid-Atlantic Coastal Plain. Segments of the Choptank River have been classified as “impaired waters” under the Federal Clean Water Act. Much emphasis has been placed on implementing effective mitigation strategies to reverse these trends. To assess effectiveness of conservation practices, monthly baseflow stream samples were collected from 15 agricultural subwatersheds of the Choptank River over a period of three years and river samples were collected at seven locations. Samples were characterized for nutrients, herbicides and their transformation products, metals and several basic water quality parameters. High resolution digital maps of land use and hydrologic features were derived from remote sensing imagery. Results suggest that agrochemical transport processes are similar to nutrients in some cases and in others, the processes are not, and that landscape features affect these processes differently. Riparian buffers can mitigate overland flow of nutrients and pesticides but they can also trap volatilized pesticide residues in the tree canopy. During rain events, these captured residues can be washed off and delivered to nearby streams. Characterization of the transport mechanisms will assist land managers in targeting the implementation of improved management practices to critical landscape areas.

AGRO 67
National stewardship program to mitigate carbamate pesticide risk in drinking water

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A stewardship program is presented to mitigate the potential exposure risks of a carbamate pesticide in surface and groundwater drinking water sources. Use patterns having potential risks were identified using a combined GIS and simulation modeling approach. Specific stewardship measures, selected and verified using simulation models, include crop and geographical restrictions at the state and/or county level; restrictions on formulation, application methods, and application rates; site restrictions based on soil texture, pH, and depth to groundwater; and runoff, drift, and well-setback buffers. An web-based reporting system, that requires certified applicators to document application sites, allows the registrant to monitor in real-time the percent watershed area treated for individual community water supplies across the nation.

AGRO 68
Comparison of approaches for mitigating off-site transport of sediment-associated pesticides

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Pyrethroid insecticides are among the pollutants transported from irrigated fields to nearby surface waters largely adsorbed to suspended particles. Field trials were conducted at three sites in California to evaluate several approaches to reduce loss of suspended sediments and associated pyrethroids. The most effective approach involved use of polyacrylamide (PAM) in irrigation water, which achieved over 80% reduction in suspended sediment. PAM is available in a variety of formulations, and all appeared effective, though the oil-based products themselves raise aquatic toxicity issues. Use of vegetated tailwater ditches also provided substantial benefit, though less so than PAM. Sediment traps, sized to provide at least an hour residence time for tailwater, had negligible effect in reducing sediment and pyrethroid loss. Finally, trials done with an enzyme designed to hydrolyze pyrethroids, had no effect on sediment loss, as would be expected, but did reduce the pyrethroid concentration in the tailwater by approximately 50%.

AGRO 69
Estimating pesticide retention efficacy for edge of field buffers using the Riparian Ecosystem Management Model (REMM) in southern Atlantic Coastal Plain landscapes

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Southern Atlantic Coastal Plain croplands are vulnerable to runoff; thus agricultural pesticide use may adversely impact surface water quality. Our research group has collected data over the past 5 years indicating that this is not the case in Little River Experimental Watershed (LREW) located in coastal plain of southern Georgia. This was likely attributable to the extensive riparian forests within the watershed which intercept surface and subsurface runoff and retain pesticides and other contaminants. The Riparian Ecosystem Management Model (REMM) developed and supported by our research group was recently modified to simulate pesticide retention processes. In this presentation we will demonstrate use of the model in simulations of pesticide retention by forested and grassed buffers and to quantitatively assess buffer design parameters. Models inputs are from a 10-year field scale investigation of tillage impact on water quantity and quality during rotational cotton and peanut production.

AGRO 70
Comparison of models for estimating the removal of pesticides by vegetative buffer strips

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Vegetated buffer areas established between agricultural fields and receiving waters have long been recommended as a best management practice to reduce the amount of sediment, nutrients, and pesticides entering water bodies and recently intensively managed vegetated filter strips have been mandated as label requirements for plant protection products in both Europe and North America. Also recently, models have been developed to predict the amount of active ingredients and their metabolites removed from runoff flowing through these strips. This research has shown that the removal efficiency is a function of several parameters and must be predicted on an event basis. This presentation reviews the features of five models (APEX, PRZM, REMM, SWAT, and VFSMOD-WQ) which can be used to predict the reduction in pesticide loss in runoff passing through a vegetative buffer strip and compares the predictions of four of these models using common data sets.

AGRO 71
Vegetative filter strip efficacy study: Design, conduct, and simulation modeling of field data

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A field study was conducted to assess the effectiveness of a vegetative filter strip (VFS) in reducing the transport of the insecticide novaluron in off-field runoff and erosion. The presence of a Bermuda grass VFS reduced novaluron transport by approximately 65% and 50% following intense simulated rainfall conducted two and six days after novaluron application, respectively. The study demonstrated that a VFS was effective in significantly reducing novaluron residues in runoff. Simulation modeling was conducted to assess the performance of the Pesticide Root Zone Model (PRZM) and coupled Riparian Ecosystem Management Model (REMM) at estimating runoff, sediment, and pesticide trapment by a VFS adjacent to an agricultural field. Model estimations were compared to observed results from the VFS effectiveness study. The simulation modeling demonstrated that PRZM3.12 linked with REMM can be an effective tool for estimating runoff, sediment, and pesticide trapment by a VFS adjacent to an agricultural field.

AGRO 72
Review of vegetated buffers and a meta-analysis of their mitigation efficacy in reducing nonpoint source pollution

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Vegetated buffers are well studied agricultural management practices for reducing nonpoint-source pollution. This paper aggregated existing results and quantified the relationships between pollutant removal efficacy and buffer width, buffer slope, soil type, and vegetation type. Theoretical models for removal efficacy were derived and tested against data from the surveyed literature. Buffer width explains 37, 60, 44, and 35% of the total variance in removal efficacy for sediment, pesticides, N, and P, respectively. Buffer slope is linearly associated with sediment removal efficacy either positively (when slope 10%) or negatively (when slope > 10%). Buffers composed of trees have higher N and P removal efficacy than buffers composed of grasses or mixtures of grasses and trees. Soil drainage type does not show a significant effect on pollutant removal efficacy. These models predicting optimal buffer width/slope can be instrumental in the design, implementation, and modeling of vegetated buffers for treating agricultural runoff.

AGRO 73
Modeling the effectiveness of mitigation measures on the diazinon labels

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An exposure assessment model was developed to evaluate sources of diazinon in the Main Drainage Canal, a 38,000-acre watershed located within the Sacramento River Basin in Butte County, California. Management practices that have been added to diazinon labels (limiting applications to ground applications during the dormant season, requiring a 10' vegetative filter strip to reduce runoff and a 100' application setback to reduce drift, limiting applications if soils are saturated or if rainfall is forecast within a 48-hour period, encouraging optimum timing for application based on larvae count/development, and restricting applications based on wind speed and wind direction to minimize spray drift) are likely to provide considerable reductions in diazinon loadings and concentrations in the Main Drainage Canal. In combination, these label practices were predicted to provide an approximate 50 percent reduction in concentration for high exposure events. Similar reductions are likely to occur in other areas of the Sacramento River basin that have similar use density and climate.

AGRO 74
Reassessment of tolerances of inert ingredients under FQPA

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The Food Quality Protection Act (FQPA) requires EPA to conduct reassessment of tolerances or exemption from tolerances for inert ingredients that were in place prior to August 3, 1996. The FQPA requires EPA to consider special sensitivity of infants and children to exposure to pesticides and also requires to consider exposure to inert ingredients from all sources of exposure. Since the passage of the FQPA, EPA has reassessed inert ingredients and established exemptions from tolerances for those inert ingredients that met FQPA requirements. During this reassessment, certain inert ingredients from surfactants class did not meet the FQPA safety evaluation criteria due to limited of available toxicity data. Therefore, the exemption from the tolerances for these classes of surfactants was revoked due to insufficient data. EPA set criteria for additional necessary data and worked closely with industry to conduct additional testing. The detail of approach utilized by EPA will be discussed.

AGRO 75
The Joint Inerts Task Force (JITF), an effective task force model

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On August 6, 2009, EPA issued revocation notices for 130 pesticide inert tolerance exemptions that potentially affected more than 500 compounds from 30 different chemical classes due to insufficient FQPA relevant developmental and reproductive toxicology data. The Joint Inerts Task Force (JITF), that was formed to address the revocations, provided a unique and effective framework for the manufacturers and registrants to generate and provide EPA the necessary data to make tolerance exemption decisions. This framework is also applicable to other regulatory initiatives, such as REACH and HPV. JITF Executive Committee, composed of an equal number of 5 inert registrants and suppliers, provided oversight for the 23 Task Force companies and facilitated the coordination of the Cluster Support Teams, formed to defend specific groups of chemistries. External Administrative and Technical Managers were responsible to direct Cluster Teams and EPA activities.

AGRO 76
New paradigm for inert risk assessments

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In 1996 Congress passed the Food Quality Protection Act of 1996. One of the impacts of this legislation was to introduce the regulatory mandate to make a finding of "reasonable certainty of no harm" for the U.S. population and for all regulated subgroups, including infants and children. In light of the need to make an affirmative safety finding for inert ingredients as well as conventional chemicals, EPA developed a revised approach to inert ingredient risk assessment. The Agency recently completed risk assessments for a wide number and range of surfactants.

The approach to these risk assessments included clustering surfactants into groupings and requiring toxicity testing on the most toxic compound in the cluster; considering the physical, chemical and biological properties of these compounds; developing a revised approach to endpoint selection; and conducting high end dietary exposure and non-dietary exposure assessments.

AGRO 77
Overview of risk assessment results for the JITF inert ingredient clusters

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Using the approaches and tools developed specifically for the conduct of risk assessments for inert ingredients at the cluster level, EPA conducted initial Tier 1 default risk assessments for each cluster of inert compounds under the purview of the JITF. In several cases, risks of concern were identified, which therefore required mitgation and refinement. Risks of concern were associated with either dietary or residential exposures individually or at the aggregate level. Refinements took the form of introducing restrictions on the maximum percent of inerts in formulations, and the JITF played a key role in developing information to understand which restrictions were commercially feasible. This presentation reviews the results from EPA decision documents for the JITF clusters, with a focus on the refinements that were introduced to yield aggregate assessments with no risks of concern.

AGRO 78
Applying cluster analysis to pesticide inert tolerance reassessment

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Since structurally related substances generally have similar physical, metabolic and toxicological properties, it is possible to cluster and then bridge (read-across) testing results from one compound to other compounds within the group. Read across cluster analysis has been successfully applied in HPV programs, to reduce animal testing and the time to conduct and review study data. Similarly, the EU has recommended cluster analysis for REACH. The revocation of 130 pesticide inert tolerances, due to insufficient FQPA relevant reproductive and developmental toxicity data, generated an unprecedented regulatory challenge for industry and EPA. By applying cluster read-across analyses, the Joint Inerts Task Force was able to develop 22 OECD 422 Studies (Combined Repeated Dose Toxicity Study with the Reproduction/Developmental Toxicity Screening Tests) test plans for 430 compounds, from 30 different classes of surfactants and then submit 18 tolerance reassessment petitions within two years.

AGRO 79
Global "Reach" of recent EU legislation and raw material issues for agrichemical formulation trends

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European legislation for chemicals has broad impact on the availability of co-formulants for agrichemical use globally. Two key current forces are REACH and the European implementation of Regulation on classification, labeling and packaging (CLP). The specifics of how these processes are applied and the effect of these initiatives on co-formulant usage and formulation trends within the agrichemical industry will be discussed.

AGRO 80
Impact of coformulant regulation on pesticide formulations

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Regulations on use of co-formulants in agricultural pesticide formulations have been increasing at a significant rate. This talk will describe a new tool for predicting the vulnerability of co-formulants to regulation. This tool utilizes existing data on mammalian toxicology, ecotoxicology and environmental fate for these co-formulants along with other parameters to rank the vulnerability of over 600 co-formulants currently used in pesticide products. Regulations restricting use of commonly used co-formulants, such as aromatic solvents, co-solvents and surfactants have stimulated research into new replacement co-formulants and new formulation types. Impact on formulations will be examined through case studies of innovative formulation solutions.

AGRO 81
Utilizing solvent blends to maximize green characteristics of emulsifiable concentrate formulations

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Many agrichemical solvents traditionally used in emulsifiable concentrate formulations are not considered to be green due to their high volatile organic compounds (VOCs), non-renewable feedstock sources, and/or potential impact on human health. However, green solvents often cannot support the level of solubility needed when creating a marketable product, and can significantly increase formulation costs. Blending solvents can maximize green characteristics while maintaining marketable solubility levels and controlling cost. Blends can also be used to optimize the physical characteristics of the final product to meet specific application requirements. The linear relationship between solvent concentration and active solubility can be used to identify potential solvent options for obtaining required solubility. Evaluations of VOCs, eye irritation, cost, biorenewable carbon index, freeze and pour point characteristics for individual solvents and subsequent blends provide additional data that can be used to predict the ideal components and concentrations of a solvent blend.

AGRO 82
Use of yeast proteins to affect the function of surfactants and their application in agricultural formulations

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Surfactants have long been used to affect the structure and function of proteins in certain applications. However, the use of proteins to affect the function of surfactants has not been explored. This work shows that small proteins (<30 kDa) derived from heat-shocked yeasts improve the performance of a broad range of surfactants. Proteins produced by stressed yeast reduce the critical micelle concentration (CMC) of example systems of various surfactants. Interfacial tension (IFT), dynamic surface tension (DST) and contact angles were all reduced in the presence of these proteins beyond the level achieved by the synthetic surfactants in the absence of proteins. Several varieties of agrochemical formulations including soluble liquids, microemulsions, and suspension concentrates were prepared including proteins and surfactants together as a built-in adjuvant system. The efficacy of some of these formulations was explored. Further experiments detail the enhanced spreading and uptake of aqueous solutions into green leaves (such as cabbage or tomato) using protein surfactant blends, as compared to synthetic surfactants taken alone.

AGRO 83
Clearing the air: Livestock's contribution to climate change

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A United Nations report titled Livestock's Long Shadow (LLS) stated that 18% of anthropogenic greenhouse gases (GHGs) are emitted from the world's livestock. According to LLS, livestock cause more anthropogenic GHG than all global transportation. Recent estimates by the United States Environmental Protection Agency (EPA, 2009) on the impacts of livestock on climate change have arrived at much different GHG estimates. EPA estimates that less than 3% of total anthropogenic GHG are associated with direct and indirect livestock emissions. Part of the difference of the global versus national predictions is due to the weight assigned to ''land-use change'' patterns related to livestock production (mainly deforestation). Furthermore, LLS attempts a life cycle assessment for global livestock production but not for transportation predictions. Our work has examined the relative contributions of livestock to climate change at different geographical and production scales.

AGRO 84
Emissions from Holstein and black Angus-cross feedlot steers and calves

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Greenhouse gas (GHG) emissions were measured from 54 steers and calves. Animals types were assigned to the following groups with three animals per group: 1) 544 kg Holstein steers, 2) 544 kg Black Angus-Cross steers, 3) 340 kg Holstein steers, 4) 340 kg Black Angus-Cross steers, 5) 159 kg Holstein steers, and 6) 54 kg Holstein calves. Cattle were housed in an environmental chamber for 24h and their waste remained inside for an additional 24h. Carbon dioxide and nitrous oxide were measured using an INNOVA 1412 gas monitor and methane using a TEI 55C methane analyzer. Greenhouse gases increased when steers entered the chamber. Correlations between GHG, body weight and cattle breed were identified ($P < 0.05$). Greenhouse gases are mainly produced by enteric fermentation and respiration and differ greatly across life stages of cattle.

AGRO 85
Effects of dietary monensin on greenhouse gases from lactating dairy cows and waste

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Lactating dairy cows fed monensin sodium (monensin; MON), a feed additive and rumen microbial modifier, were compared with untreated control cows (CON) with respect its effects on greenhouse gas (GHG) emissions and the microbial population structure of fresh feces. Measurements of GHG were collected when cows were on feed on days 14 and 60in an environmental chamber simulating commercial dairy freestall housing conditions. The microbial population structure of feces from 6 MON and 6 CON cows was examined on three different occasions (days 14, 30, and 60). Monensin did not affect emissions of the GHG methane, nitrous oxide, and carbon dioxide. The microbial population structure of the fresh waste was also unaffected for MON versus CON cows. A follow-up study will investigate monensin's effect on rumen microbial populations and eructated, rumenal, and fecal GHG emissions by feeding lactating dairy cows either 0, 200, 400, and 600 mg/hd/day of monensin.

AGRO 86
Effects of biotechnology on greenhouse gases in feedlot cattle

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The feedlot industry widely uses biotechnologies such as antibiotics, growth implants, and $_2$-adrenergic agonists to improve health and growth performance of cattle. These biotechnologies alter microbes in the rumen and alter nutrient retention in the animal, which may lead to reductions in methane (CH_4) and nitrous oxide (N_2O). The present study investigated greenhouse gasses (GHG) of 160 black angus steers housed in groups of 10. Animals were housed in totally enclosed cattle pen enclosures (CPEs). Four treatment groups were compared simultaneously over four

treatment periods using a 4 by 4 Latin square design (n = 4). Control cattle were compared with three treatments that included antibiotics, growth implants, and 2-adrenergic agonist. The present study will provide a better understanding of how antibiotics and growth enhancement application use in feedlot cattle affect GHG.

AGRO 87
Effects of birdsfoot trefoil on nitrogenous gases from dairy cows and manure

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The present study investigated the effects of the forage birdsfoot trefoil (BFT) on nitrogenous gases from dairy cows and their fresh manure. Eighteen lactating Holstein cows were randomly assigned to one of the two treatments: 1) alfalfa based ration (ALF), and 2) BFT ration. Within each treatment, nine cows were randomly assigned to three groups (experimental unit, n=3). Animals were fed their diets for 8 days after which they were placed in an environmentally controlled chamber for 12 hours to measure gas emissions. The results showed that BFT versus ALF fed cows decreased ammonia and nitrous oxide emissions. BFT might improve the protein utilization efficiency by cows and could be a viable feed to reduce nitrogenous gases from fresh manure of dairy cows.

AGRO 88
Improved productivity reduces greenhouse gas emissions from animal agriculture

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Greenhouse gas emissions from animal agriculture are of considerable concern to the producer and consumer. It is therefore crucial to adopt technologies and management practices that maximize productive efficiency in order to reduce resource input and waste output per unit of food. Deterministic models based on cattle nutrient requirements and metabolism were used to quantify the environmental impact of US dairy and beef production compared to historical practices. Improved dairy productivity reduced the carbon footprint per kg of milk by 63% between 1944 and 2007. Advances in genetics, growth rate, and nutrition since 1975 also allowed beef producers to improve productivity. Consequently, U.S. beef production in 1975 totaled 10.9 billion kg from 40.9 million head of commercial cattle slaughtered, compared to 12.0 billion kg from 34.3 million head in 2007. This is equivalent to an average increase in meat production of 84.4 kg/animal, with a consequent reduction in environmental impact.

AGRO 89
Biofuel GHG emissions from indirect land use change (iLUC): Surveying the model landscape

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Indirect greenhouse gas (GHG) emissions occur when biofuel feedstock displaces agricultural production and causes additional land-use change elsewhere, potentially leading to an increase in net GHG emissions. The magnitude of the "iLUC effect" varies considerably across studies, adding to controversy over policymakers' use of findings in formulating regulations. This paper identifies some sources of divergence in models' estimates of biofuel-related GHG emissions within the different methods, assumptions, scenarios, and model combinations chosen to represent energy, agricultural, and land use sectors, as well as to account for GHG emissions from the land use change. Key factors include: modeling of biofuel coproducts used in other (e.g., livestock) sectors; restrictions on international trade; consideration of unmanaged land; and treatment of carbon stocks during conversion and beyond and of non-CO_2 emissions. Comparing myriad approaches can inform policymakers' assessments of findings as well as future model development by highlighting areas of agreement, disagreement, and uncertainty.

AGRO 90
Measurement of methane and nitrous oxide emissions from broiler houses in California

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The emissions of greenhouse gases from a broiler farm in California were continuously measured for a one year period as part of the National Air Emission Monitoring Study. Other air pollutants measured in this study include ammonia, carbon dioxide, ethanol and other volatile organic compounds, and particulate matter ($PM_{2.5}$, PM_{10}, and TSP). Ventilation and environmental control parameters and manure and littler management practices were also measured and monitored. This paper presents the measurement results for daily emission rates and total emissions of methane and nitrous oxide, as well as ventilation and environmental control parameters.The two broiler barns had identical structural design and ventilation, feeding and litter management practices. Each barn contained about 21,000 broilers in each production cycle and was mechanically ventilated. The environmental parameters monitored included temperature, relative humidity and static pressure inside the houses, and ambient temperature, relative humidity, wind speed and direction, and solar radiation outside the houses.Average ventilation volume per broiler during a growth cycle was 2341 m^3, and ranged from 1161 to 5214 m^3.

AGRO 91
Preliminary studies on fungal inhibition in stored swine feed treated with the Brazilian *Chenopodium ambrosioides* L. essential oil

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Anti-fungal activities of essential oils (EOs) have been extensively evaluated in laboratory but few studies have been conducted with cereals. Hence, in this study we extended our laboratory studies on the antifungal activity of the Brazilian *Chenopodium ambrosioides* EO, which was found to be very active against eight fungi in our previous laboratory studies. Humidity of a commercially available swine feed sample was adjusted to 15 and 18%, treated with 0.1% EO and stored for 90 days. After 30, 60 and 90 days, ergosterol (ERG) was quantified by GC- MS-SIM. From the ERG concentrations, fungal inhibition (%) was calculated. Significantly lower ERG concentration (5% probability) was found in the EO-treated feed samples, as compared to untreated feed samples after 60 and 90 days of storage at 15 and 18% humidity (Table 1). Also, about 95% fungus inhibition was obtained for EO-treated feed stored for 30, 60 and 90 days at 15% humidity.

Table 1: Average ergosterol concentrations in blank and feed* without and with *Chenopodium ambrosioides* essential oil (EO), respectively in swine feed stored for 30, 60 and 90 days with 15 and 18% humidity, respectively.

Treatment	Average ergosterol concentration**(mg/g of feed) after					
	30-day storage		60-day storage		90-day storage	
	15%	18%	15%	18%	15%	18%
Without EO (blank)	0.36*** Aa	0.46Aa	1.50Ab	2.20Aa	7.92Ab	14.43Aa
With EO (0.1%)	0.03Aa	0.11Aa	0.06Bb	1.76ABa	0.35Bb	5.61Ba

- *Average concentration of 0.05 mg/g of feed before storage
- **Average of three repetitions.
- *** Averages followed by the same upper case letter in a column or a lower case letter in a row are not different by Tukey test at 5% probability.

AGRO 92
Herbicidal activity of sorgoleone analogs

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Allelopathy is the inhibition of growth of a plant through the production of phytotoxins released by another plant. Sorghum is considered one of the most allelopathic species. Sorgoleone (2-hydroxy-5-methoxy-3-[(*Z*,*Z*)-8_,11_,14_-pentadecatriene]-*p*-benzoquinone) is the major component for the growth inhibitory activity of sorghum. In the search for natural and natural-based herbicides for pest management, a set of quinone derivatives was synthesized and tested for phytotoxicity against a monocot (*Agrostis stolonifera*) and a dicot (*Lactuca sative*) species. Quinones with side chain of sizes varying from 1 to 14 were synthesized. The best compound, 2-hydroxy-5-methoxy-3-pentylcyclohexa-2,5-diene-1,4-dione, with a side chain of 5 carbons, showed activity very similar to sorgoleone. At 0.1 mM concentration, the quinone had moderate toxicity against bentgrass growth and development, and at 1.0 mM it completely inhibited germination of lettuce.

AGRO 93
Natural furoquinoline alkaloids as photosynthetic inhibitors in spinach chloroplasts

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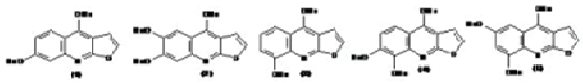
Natural alkaloids: evolitrine (**1**), kokusaginine (**2**), γ-fagarine (**3**), skimmianine (**4**) and maculosidine (**5**) were isolated from *Balfourodendron riedelianum*. Their effects on photosynthesis were tested, and the alkaloids **1**, **2**, **4** and **5** inhibited: ATP synthesis; basal, phosphorylating and uncoupled electron transport, therefore they act as Hill reaction inhibitors. Alkaloid **3** was not active. The inhibition and interaction site on the non-cyclic electron transport chain of alkaloids **1**, **2**, **4** and **5** was studied by pollarography and fluorescence of the chlorophyll a. The alkaloids inhibited basal, phosphorylating and uncoupled electron transport in different degrees as their concentrations increases up to 100 µM. The results indicated tha the alkaloids target is on the aceptor side of PSII, at Q_B. The herbicide DCMU acts as inhibitor of PSII, binding at the Q_B site. DCMU inhibited 100% of activity of Hill reaction at 1 µM.



AGRO 94
Alkynylation of aryl aldehydes using alkynylboron dihalides

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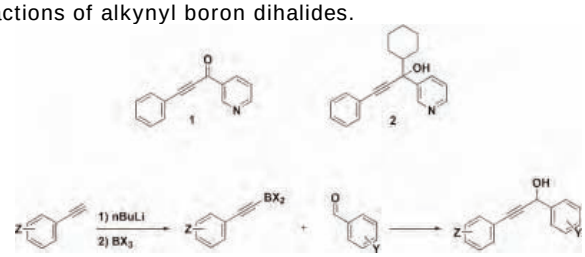
Many alkyne containing compounds exhibit biological activity and are reported to show fungicidal, insecticidal, and algicidal activity. Propargylic alcohols and ketones such as **1** and **2** are active against fungi such as Sphaerotheca fuliginea (cucumber powdery mildew). We wish to report a new, transition metal-free method for preparing a wide variety of propargylic alcohols and related ketones utilizing reactions of alkynyl boron dihalides.



AGRO 95
Pyridostigmine bromide interferes with the inhibition of AChE by agricultural chemicals

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When the Department of Defense reported treatments with carbamates interfered with the toxicity of chemical warfare agents, pyridostigmine bromide (PB) was approved for dosing troops. Experiments reported here show that PB also protects against inhibition of acetylcholinesterase (AChE) by

organophosphate ester pesticides (OPs). Bovine red blood cells (RBCs) were pretreated with 10^{-5} M PB followed by diisopropylfluorophosphate, diazinon-oxon, chlorpyrifos-oxon, or controls. Blood was drawn from the Animal Science Dairy herd. AChE activity was determined by the Ellman assay. PB concentration was set to inhibit approximately 50% of AChE; washed RBCs recovered $\geq$95% activity; OPs inhibited $\geq$99% AChE and did not recover. Pretreatment with PB protected 20 – 42% of the OP-inhibited AChE activity. These findings suggest farmworkers or first responders working where OP exposure may be unavoidable could benefit from prior treatment with PB. Supported by the UCD Agricultural Experiment Station and USDA Western Regional Project W-1045.

AGRO 96
Analysis of phytotoxic fungal toxins from *Ascochyta caulina* liquid culture

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Ascochyta caulina (P. Karst.) v.d. and v. Kest, is a promising biological control agent for the control of *Chenopodium album*, a common weed of crops such beet and maize. *A. caulina* produce in liquid culture hydrophilic phytotoxins, namely, ascaulitoxin, its aglycone, and 4-aminoproline. A method was developed for the analysis of these fungal toxins using gas chromatography-mass spectrometry (GC-MS), which involved directly treating the lyophilized culture filtrate with a derivatizing reagent and analyzing the compounds as trimethylsilyl derivatives. The method is rapid, sensitive, and highly specific, and allowed accurate quantitation of the toxins in a complex sample matrix. Analysis of samples from three production cultures revealed that the phytotoxic activity of the liquid culture is dependent on the levels of ascaulitoxin. Data from GC-MS analysis are in agreement with results obtained from leaf-puncture assays.

AGRO 97
Determination of albendazole and its metabolites in the muscle tissue of yellow perch using liquid chromatography with fluorescence detection

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A liquid chromatographic method was developed for the determination of albendazole (ABZ) and its metabolites, sulfoxide (ABZ-SO), sulfone (ABZ-SO_2) and albendazole-2-aminosulfone (ABZ-2-NH_2SO_2) from yellow perch muscle tissue with adhering skin. The extraction and clean-up methods of yellow perch muscle tissue were modified from previous studies on tilapia and other fishes. The muscle tissue samples were made alkaline with potassium carbonate and extracted with ethyl acetate. The extracts were subjected to cleanup by a series of liquid–liquid extractions. After solvent evaporation, the residue was reconstituted with mobile phase and chromatographed. HPLC condition was modified from two isocratic systems to a single gradient method, carried out on a reversed-phase Luna C18(2) column. The buffer was 50 mM ammonium acetate (pH=4.0) in 10% methanol-water. The gradient began from 20% of acetonitrile and 80% of buffer to 85% of acetonitrile and 15% of buffer. The analytes were detected by fluorescence with excitation and emission wavelengths of 290 and 330 nm, respectively. The average recoveries from fortified muscle tissue for ABZ (20–100 ppb), ABZ-SO (20–200 ppb), ABZ-SO_2 (1–100 ppb), and ABZ-2-NH_2SO_2 (20–100 ppb) were 85, 100, 101, and 97%, respectively. The coefficient of variation was £ 13% in all cases. The procedure was applied to determine ABZ and metabolites in the tissue of yellow perch after orally dosing with ABZ. In a pilot study, one fish each was dosed with ABZ (10 mg/kg) and necropsy was performed at 24, 48, 72, 96 and 120 hr. The concentration level of ABZ-SO and ABZ-SO_2 reached peaks at 24hr (199 ppb) and 72hr (553 ppb), and down to 8 and 168 ppb at 120hr, respectively. ABZ and ABZ-2-NH_2SO_2 were only detected at 24 and 96 hr, respectively. A full residue depletion study is being performed to confirm our results.

AGRO 98
Phenotypic plasticity of disease-vectoring mosquitoes towards non-chemical and chemical stressor interactions

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Disease-vectoring mosquitoes affect millions of people worldwide. The mosquito nervous system is a proven target for high efficacy insecticides; however, widespread resistance limits their use to reduce mosquito-borne infections. Mosquito phenotypic plasticity provides counteractive measures for individuals to exploit numerous habitats and survive fluctuating environmental conditions. Such counteractive measures increase the ability to withstand insecticide exposures and, thus, identification of resistance mechanisms provides insight for developing improved control strategies for disease-vectoring mosquitoes. This study examines the ability of disease-vectoring mosquitoes to adapt to and survive oxygen-deficient conditions using a hypoxia-responsive signaling pathway for acquiring and conserving oxygen for essential metabolic pathways. We will report the influence of this pathway on detoxification enzymes that elicit the biological and toxicological action of current-use insecticides, and discuss how phenotypic plasticity for adapting to oxygen availability has the potential to influence mosquito susceptibility toward current-use insecticides.

AGRO 99
Chronic and acute dietary risk assessments based on simulated residue data

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Chronic and acute dietary risk assessments based on simulated residue data are presented. In the chronic case, Theoretical Maximum Daily Intakes (TMDIs) were calculated based on the Maximum Residue levels (MRLs) as given by the OECD MRL Calculator. The TMDI was compared with International Estimated Daily Intake (IEDI) calculation. The IEDIs were calculated based on the Supervised Trial Median Residues (STMRs) with a factor to account for the inedible fraction of the crop and changes in residues due to processing and cooking. Both the TMDIs and IEDIs were expressed as percentages of the Acceptable Daily Intakes (ADIs) so the impact of the additional factors could be assessed. In the acute case, International Estimated Short-term Intakes (IESTIs) were calculated for the general population and for children using the STMRs and Highest Residues (HRs) from the field data. The IESTIs were expressed as percentages of the Acute Reference Doses (ARfDs).

AGRO 100
Thiencarbazone-methyl: A new molecule for pre- and post-emergence weed control in corn

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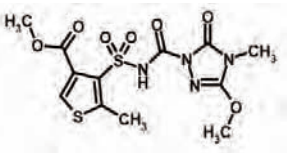
Thiencarbazone-methyl (TCM) is a new sulfonylaminocarbonyltriazolinone (SACT) from Bayer CropScience that controls grassy and broadleaf weeds through inhibition of acetolactate synthase. TCM is taken into the weeds through aerial portions of the plants and from the soil. Therefore it provides a strong residual component for weed control. TCM controls weeds of corn at rates as low as 8g active ingredient per hectare (g ai/ha), and will be used up to 15g ai/ha per postemergence application. Lower rates have also been demonstrated to be effective at controlling key weeds in wheat. As a soil-applied herbicide, TCM will be applied at rates up to 37g ai/ha per single application. In corn, TCM will be combined in various premixtures with other complimentary herbicides and proprietary crop safeners. - The optimization of SACTs towards corn weed control as well as the synthesis of TCM will be presented.



AGRO 101
Screening and isolating phytochemicals in Eastern Redcedar (*Juniperus virginiana*) for developing potential entrepreneurial opportunities

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Eastern redcedar (*Juniperus virginiana, ERC*) is often considered a “trash or nuisance” invasive tree. Value-added phytochemical products from ERC have the potential to create new industries in regions where ERC is abundant. The bioactive phytochemicals within various redcedar tissues and by-products including cedar oil, cedar sawdust and various tissues including roots, leaves, fruits, branches, sapwoods, and heartwood, have been isolated and characterized with modern chromatographic, spectroscopic and bioassay technologies. Several commercial applications in agricultural, pharmaceutical, and cosmetic industries have also been identified. The isolated biologically active phytochemicals will provide the opportunities to turn abundant, low-value, renewable materials from the ERC into a lucrative, high technology industry in Missouri.

AGRO 102
Establishment of quantitative sequencing and residual filter contact vial bioassays for the monitoring of pyrethroid resistance in the common bed bug, *Cimex lectularius* L.

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To establish a population-based genotyping method as a molecular resistance monitoring tool for determining the frequency of the two mutations, a quantitative sequencing (QS) protocol was developed. The nucleotide signal ratios at the mutation sites were generated from sequencing chromatograms and plotted against the corresponding resistance allele frequencies. Frequency prediction equations were generated from the plots by linear regression, and the signal ratios were shown to highly correlate with resistance allele frequencies (r^2 > 0.9928). In addition to QS, the residual filter contact vial (RFCV) bioassay method was established and used to determine the baseline susceptibility and resistance of bed bugs to deltamethrin and l-cyhalothrin. A pyrethroid-resistant strain showed greater than 9375- and 6990-fold resistance to deltamethrin and l-cyhalothrin, respectively. Resistance allele frequencies in different bed bug populations predicted by QS correlated well with the RFCV bioassay results, confirming the roles of the two mutations in pyrethroid resistance. Taken together, employment of QS in conjunction with RFCV bioassay should greatly facilitate the detection and monitoring of pyrethroid resistant bed bugs in the field. The advantages of RFCV as an on-site resistance monitoring tool were discussed.

AGRO 103
Synthesis of 1-octen-3-ol analogs as mosquito attractants

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Mosquito control depends solely on the use of insecticides and pesticides that are expensive, toxic, and environmentally harmful to plants, animals and humans. Hence, a solution to the hazardous effects of mosquito control would be an approach that is effective, economical, and environmentally friendly, with emphasis on eliminating mosquitoes by luring them into non-toxic traps where they are destroyed. Of the known mosquito attractants, 1-octen-3-ol has proven to be effective, though it attracts some mosquito species better than others. In our laboratories, we have successfully synthesized racemic analogs of 1-octen-3-ol in good to excellent yields, which have been shown to have better mosquito attractant properties than the lead compound. These racemic analogs are now being resolved by a combination of chemical and enzymatic methods with a view to identifying the enantiomers with the mosquito attractant properties.

AGRO 104
Composition of forage and grain from second generation insect-protected corn, Mon 89034, and its combined trait products are equivalent to that of conventional corn (*Zea mays* L.)

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Insect-protected corn hybrids containing event MON 89034 provide improved protection from target pests and more effective management of insect resistance. MON 89034 hybrids produce two insecticidal Cry proteins which provide two independent modes of action for lepidopteran insect pests of corn. Combined trait corn hybrids were developed by the traditional breeding of MON 89034 with insect protected and herbicide tolerant events, MON 88017 and NK603. The composition of MON 89034 corn and its combined trait products were compared to conventional corn by measuring proximates, fiber, and minerals in forage and grain; and amino acids, fatty acids, vitamins, anti-nutrients, and secondary metabolites in grain using a mixed model analysis of variance with statistically significant difference assigned at $p<0.05$. The results of these compositional analyses established that the forage and grain from MON 89034 and its combined traits hybrids are compositionally equivalent to, and as safe as, conventional corn hybrids.

AGRO 105
Natural product based chromenes as a novel class of potential termiticide

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Among the termites infested in the United States, Formosan subterranean termite *Coptotermes formosanus* is considered as the most devastating termite pest. As part of USDA efforts to search for effective, environmentally friendly, termite control agents, natural products isolated from plant extracts belonging to various families were evaluated. A chromene amide isolated from *Amyris texana*, a plant belonging to the Rutaceae family has shown moderate activity against termites in laboratory bioassay. Based on these results a series of chromene analogs were synthesized and evaluated for activity. These compounds exhibited significantly higher mortalities compared to untreated controls in laboratory bioassay. Bioassay also indicated that these compounds act as topical toxicants to the termites. Synthesis, structure activity relationship and biological activities of these compounds will be discussed.

AGRO 106
Spatially explicit life cycle emissions from biofuel derived from wood biomass

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Bioenergy production from wood has potential to reduce greenhouse gas (GHG) emissions from the transport sector by producing low-carbon alternatives to gasoline and diesel, and potentially reducing the risk of catastrophic wildfire thereby increasing the stability of forest carbon pools. We present a spatially explicit methodology for modeling the life cycle emissions from forest-based biofuel production, tracking emissions from production, fates, and displaced fossil fuel emissions. We address the impact of management activities on the probability and severity of stand replacing wildfire and consider how forest management activities impact the growth rate of the remaining vegetation. We use scenario analysis to model the effects of management decisions on the interactions identified above. Climate change policies must consider the impact of incentivising specific forest management decisions on GHG reduction targets. The model will be useful for identifying management strategies resulting in the highest overall system-level carbon balances

AGRO 107
Synthesis and characterization of fatty acid methyl esters from waste trap grease using heterogeneous acid catalysts

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Biodiesel (BD) is the name given to fatty acid methyl esters (FAME) intended for use as an alternative diesel fuel that contributes little to global warming. Typically BD is produced from soybean oil using a homogeneous base catalyst (e.g., sodium methoxylate) in methanol through a process known as transesterification. Previous work has shown that the main expenses of BD production are the feedstock and homogeneous catalyst employed. To improve the economic competitiveness, waste greases, whose commercial value is typically one half to two thirds that of refined fats and oils, are desired alternative feedstocks for the production of BD. Despite the advantages of the low cost feedstocks, these greases typically contain not only glycerides, but also free fatty acid (FFA) in amounts between 2 and 90 wt%. The FFA in the waste greases present major problems when treated with sodium methoxylate catalyst, thus an acid pretreatment step (also known as esterification) is required to convert the FFA to FAME, reducing the FFA content to an acceptable level (<1 wt%). In this poster, a one-step efficient and sustainable process for converting waste trap greases with 92 wt% FFA and 8 wt% glycerides to > 95 wt% FAME using heterogeneous solid acid catalysts (i.e., immobilized diphenylammonium triflate salts) and methanol at 125ºC for 1 hour will be presented. The solid catalysts were easily removed by filtration after esterification, thus eliminating the neutralization step and were found to catalyze simultaneous esterification of FFA and transesterification of glycerides. This process potentially can decrease the production cost. The desired FAME products were characterized by Nuclear Magnetic Resonance and High Performance Liquid Chromatography. The solid catalysts were found to work just as well as the commonly used homogeneous liquid catalysts. This work serves as an important and sustainable route to the production of biodiesel from low value-added waste materials.

AGRO 108
Effect of water on base-catalyzed transesterification of soybean oil with methanol over promoted hydrotalcite catalysts

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Solid base porous metal oxide (PMO) catalysts were prepared by calcination of synthetic hydrotalcite-like materials having the stoichiometry: $[Mg^{2+}_{6-x}\ M^{2+}_{x}\ Al^{3+}_{2-y}$

$M^{3+}_y(OH)_{16}]CO_3$ zH_2O where substituent divalent ions M^{2+} were Cu^{2+} or Ni^{2+} and trivalent ions M^{3+} were Ga^{3+}, Fe^{3+}, or La^{3+}. These solids were characterized by elemental analysis and powder x-ray diffraction. The reactivities of these PMOs in a methanol transesterification of soybean oil were ascertained in a 400 mL batch pressure reactor at 150°C under autogeneous pressure with 10 g of substrate and 0.2 g of catalyst and excess neat methanol (100 mL). The major products were fatty acid methyl esters and glycerol. The most reactive catalyst (82% conversion per hour) was Cu-20 PMO (x = 1.5). The effect of various concentrations of water on the transesterification of soybean oil using these catalysts was studied to determine their activity in the presence of water as well as the effect of leaching.

AGRO 109
Discovery and characterization of hemicellulose-degrading enzymes

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Hemicellulose is the second-most common component of lignocellulosic biomass. To increase the efficiency of biomass refineries, it is important to utilize the hemicellulose substrate fully. Many different enzyme activities are required to completely hydrolyze the hemicellulose to monomer sugars which can then be fermented to value-added chemicals. Our focus is on the discovery of new hemicellulolytic enzymes. We have screened environmental libraries for novel enzyme activities. We will describe the biochemical characterizations of these enzymes which include xylanases, beta-xylosidases, and alpha-glucuronidases.

AGRO 110
Energy saving processes for several basic chemical stuffs from biomass and carbon dioxide

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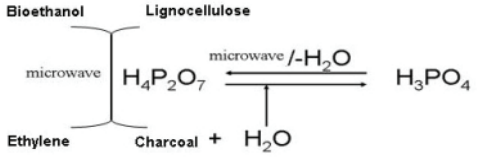
The renewable biomass energy is arrested all of the world's attention for the replacing of petroleum. Our research achieves the purpose of preparing basic chemical stuffs from biomass and carbon dioxide by simple, efficient and energy-saving methods. We disclose that carbon monoxide can be made instantly when the carbon dioxide contacts with biocarbon at the temperature above 400°C by microwaves. The advantage of the process is that no fossil energy such as coal, petroleum and natural gas is needed to prepare carbon monoxide with the recycle of carbon dioxide and biomass. We also develop a catalytical system of polyphosphoric acid←→ phosphoric acid for the microwave-assisted flash process to obtain ethylene from bioethanol and charcoal from lignocellulose. The focused sunlights can substitute for microwaves in the three processes.



AGRO 111
Predictors of current-use urinary pesticide metabolite levels among pregnant women in the CHAMACOS cohort

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We measured four pyrethroid metabolites, and ten specific and six nonspecific dialkyl phosphate metabolites of organophosphate (OP) pesticides in urine samples collected two times during pregnancy from 538 women living in the Salinas Valley, CA. Sampling of this largely Latina population occurred between November 1999 and December 2001. Over 80% of women had detectable levels of at least one of the ten OP pesticide-specific metabolites we measured, and >30% had two or more. Results from multivariate mixed models of repeat metabolite measurements (as the outcome variable) and exposure predictor variables (as the independent variables) suggest that diet and working in agriculture are associated with increased OP metabolite levels. We will present geocoded regional pesticide use reporting data to determine the relationship between metabolites detected and physically and temporally proximate agricultural pesticide applications. The cumulative effect of pesticide exposure on pregnant women and their offspring is not known.

AGRO 112
Instructions on household pesticide labels: Comparison with agricultural pesticide labels

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Label instructions for agricultural pesticides differ from those with only home uses. Agricultural product labels specify: maximum application rate; re-entry interval (REI) following application; and treatment interval. Consider a volatile organic compound such as 1,3-dichloropropene (1,3-D) which is used for agricultural fumigations versus a household pesticide such as para-dichlorobenzene, approved for home use as mothballs to protect clothing from insects and mildew. For 1,3-D, a maximum application rate is clearly defined. For para-dichlorobenzene, only a minimum rate (at least one pound per 50 cubic feet) is specified. For the agrochemical 1,3-D pesticide, a re-entry interval is specified and an irritating warning agent is often added to the formulation to alert bystanders of exposure. For para-dichlorobenzene, no airing period is specified and a pleasant, masking odor is often added. Implications of these differences will be discussed.

AGRO 113
Estimation of exposure of persons in California to the pesticide products that contain methomyl

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Methomyl, S-Methyl-N-(methylcarbamoyloxy) thioacetimidate, Lannate, is a broad-spectrum *N*-methyl carbamate insecticide with anti-cholinesterase activity and high acute oral toxicity. It is used for pest control in agriculture, and as fly bait in livestock quarters and commercial premises. Acute and long-term occupational exposure to methomyl was estimated for pesticide handlers and agricultural re-entry workers. Handler exposures varied by formulation type and amount, application method and work tasks, with pilots receiving the largest dermal and inhalation absorbed daily dosages. Reentry workers were subject to exposure primarily from dermal contact with dislodgeable pesticide residues accumulated on treated foliage. Workers harvesting sweet corn by hand received the highest exposure. Bystanders residing or working near methomyl-treated fields can be exposed to airborne pesticide residues. The acute inhalation exposure of adults and infants being in vicinity to methomyl-receiving fields was determined based on monitoring the air concentrations of methomyl during aerial applications.

AGRO 114
N_2O fluxes from winter wheat and cabbage field in the North China Plain

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N_2O emissions from winter wheat and cabbage field were measured during March to May in 2005 in North China Plain using an automatic measurement system. This study indicated that, N_2O emissions peaked during 2 weeks after N application and irrigation, and the N_2O emission pattern is mainly driven by the timing of N fertilization. In addition, the diurnal change of N_2O emission was similar to the pattern of soil temperature fluctuation especially during the following week after N fertilization and irrigation. During the growing season of winter wheat, N_2O flux was 9.76 g $N \cdot ha^{-1} \cdot d^{-1}$ in average, N loss through N_2O emission accounted for 0.67% of the nitrogen input. Throughout the whole growing season of cabbage, N_2O flux rate was 17.64 g $N \cdot ha^{-1} \cdot d^{-1}$ in average. N loss through N_2O emission accounted for 0.57% of the nitrogen fertilized.

AGRO 115
Spatial apportionment of N_2O emission sources from California agricultural soils using process-based biogeochemical modeling

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Nitrous oxide (N_2O), a potent greenhouse gas (GHG), contributed about 3% of California's GHG inventory. More than half of that N_2O was derived from agricultural soils. California's N_2O inventory for agricultural soils was estimated using the emission factor approach, which assumes that 1 to 2% of soil nitrogen (N) applied each year is converted to N_2O through direct emissions. However, production of N_2O from soils is a microbial process, affected by numerous soil factors governing microbial activities. This study attempts to estimate N_2O soil emissions using biogeochemical modeling. We simulated carbon and nitrogen cycling in major California cropping systems using the DNDC model based on California-specific soil, land use, and meteorological data and typical management practices. N_2O emissions from 17 types of land uses in 49 counties were simulated over 1990 to 2008. The study will provide N_2O emission mapping that reflects local land use, soil, and meteorological conditions.

AGRO 116
Chemistry of clothianidin and related compounds

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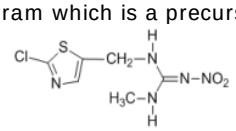
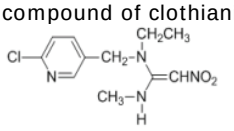
Clothianidin, a neonicotinoid class insecticide, exhibits the great biological efficacies in small amounts for a wide variety of insect pests such as *Hemiptera*, *Thysanoptera*, *Coleoptera*, *Lepidoptera*, and *Diptera*. Clothianidin has been discovered by former Agro Division of Takeda Chemical Industries (presently Sumitomo Chemical) and co-developed with Bayer CropScience, thereby the products being commercialized in more than 30 countries by both companies. Clothianidin consists of two unique structural moieties: i.e., chlorothiazole ring and open-chain nitroguanidine skeleton. In this presentation, the structure-activity relationships of guanidine derivatives and improvements of the industrial preparation of clothianidin will be mainly discussed together with the development of nitenpyram which is a precursor compound of clothianidin.



clothianidin



nitenpyram

AGRO 117
Molecular design and chemical properties of dinotefuran

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In 1992, to find a novel neonicotinoid, we attempted to substitute the aromatic rings such as chloropyridine or chlorothiazole that had been considered as dispensable for neonicotinoids previously developed. Acetylcholine, which acts on the same receptor as neonicotinoids and does not have any aromatic heterocyclic rings, was chosen as a lead compound. The research resulted in dinotefuran which has a characteristic tetrahydro-3-furylmethyl group instead of the aromatic ring. Its favorable toxicological profile and excellent insecticidal properties make dinotefuran available in wide range of crops with varity of application methods. Owing to these advantages, dinotefuran is used in many countries including the United States. The strategy of molecular design, the structure-activity relationships and the properties of dinotefuran will be presented.

AGRO 118
***cis*-Configuration: A new tactics / rationale for neonicotinoids molecular design**

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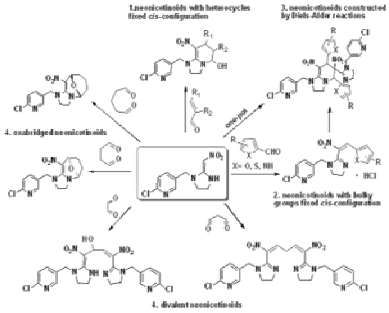
The rationale for our work involved the use of fused heterocycles or bulky groups to fix the direction of the nitro group. Based on this idea, four series of nitro-ketene neonicotinoids with cis-configuration had been designed and synthesized: (1) neonicotinoids with tetrahydropyridine fixed

cis-configuration; (2) neonicotinoids with bulky groups fixed *cis*-configuration; (3) neonicotinoids with *cis*-configuration constructed by aza-Diels-Alder reactions; (4) divalent and oxabridged neonicotinoids constructed by dialdehydes. Bioassays indicated that many of the synthesized compounds exhibited high insecticidal activities against cowpea aphids (*Aphis craccivora),* armyworm (*Pseudaletia separate* Walker) and brown planthopper (*Nilaparvata lugens*). Moreover, some of them exhibited excellent activities against imidacloprid-resistant brown planthopper.



AGRO 119
Discovery, biology and biochemistry of sulfoxaflor: A new sap-feeding insecticide

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Sulfoxaflor [N-[methyloxido[1-[6-(trifluoromethyl)-3-pyridinyl]ethyl]-λ^4-sulfanylidene] cyanamide] is the first insecticidal product from the new sulfoximine class of insect control agents. Originating from investigations into the biological activity of molecules containing a sulfoximine moiety, sulfoxaflor is a broad-spectrum insecticide exhibiting excellent efficacy against many sap-feeding insect pests, including aphids, whiteflies, hoppers, and *Lygus*. The sulfoximines, as represented by sulfoxaflor, are comparable in activity with other classes of insecticides targeted for control of sap-feeding insects, including imidacloprid and other neonicotinoids. Available data are consistent with sulfoxaflor acting via the insect nicotinic receptor. However, no cross-resistance has been observed between sulfoxaflor and neonicotinoids such as imidacloprid, apparently the result of differences in putative sites for oxidative metabolism. These observations reflect the unique structure and structure-activity relationships (SAR) of the sulfoximines compared with neonicotinoids. Details around the discovery of sulfoxaflor, the SAR of the sulfoximines, biological activity, mode of action, and cross-resistance will be presented.

AGRO 120
Chemical neurobiology of the nicotinic receptor

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High precision information on drug-receptor interactions can be obtained using unnatural amino acid mutagenesis and heterologous expression of receptors. We will describe recent insights into the detailed binding interactions involved when various drugs bind to nicotinic receptors, emphasizing variations among receptor subtypes.

AGRO 121
Analysis of structure and species selectivity of neonicotinoid insecticides using the acetylcholine binding protein as a structural template

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Acetylcholine binding proteins (AChBPs) are soluble structural and functional surrogates of nicotinic acetylcholine receptors. We determined Kd's of neonicotinoids and classical nicotinoids (nicotinic agonists and antagonists) for AChBPs from *Lymnaea stagnalis* and *Aplysia californica*. They fall between those of insect and mammalian nicotinic receptors. To complement photoaffinity labeling, we determined crystal structures of three neonicotinoid complexes and compared them with the complexes with nicotinic agonists and antagonists. The position of the chloropyridine ring in the neonicotinoids is identical to that in epibatidine. The second heterocyclic ring adopts different interactions in the nicotinoids and neonicotinoids. A critical hydrogen bond donor is formed from the protonated nitrogen in the nicotinoids, but not the neonicotinoids. The second heterocyclic ring in neonicotinoids, not carrying a positive charge, is stabilized through different determinants. Further analysis of binding and crystal structures through mutagenesis should uncover determinant selectivity for the insect receptor (NIH R37 GM 18360).

AGRO 122
Pharmacological characterization of insect nicotinic acetylcholine receptors

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Nicotinic acetylcholine receptors (nAChRs) are a diverse family of neurotransmitter receptors in vertebrate and invertebrate species. They are the site of action of neonicotinoid insecticides, as well as being targets for pharmaceutical drug discovery. A current focus of our research is to examine the influence of subunit composition upon the pharmacological properties of mammalian and insect nAChRs. Research on insect nAChRs has included studies of receptors cloned from *Drosophila* as well as from several pest species. A resistance-associated target site mutation has been identified in nAChR subunits from the brown planthopper *Nilaparvata lugans*, a major pest of rice. The mutation has a profound effect on neonicotinoid agonist potency but little or no effect on agonist activity of acetylcholine. We are now extending these findings to examine in greater detail the interaction of neonicotinoids with nAChRs. In addition, we are investigating the role of receptor-associated proteins in modulating functional expression of nAChRs.

AGRO 123
Receptor structure-guided neonicotinoid design

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Neonicotinoid agonists with a nitroimino or cyanoimino pharmacophore are extensively used throughout the world for crop protection and animal health care. Chemical biology studies on the nicotinic acetylcholine receptor structure in the neonicotinoid-bound state revealed a unique niche beyond the nitro oxygen or cyano nitrogen tip. The present investigation illustrates receptor structure-guided ligand

design for lead generation and discovery of novel insecticides. The N-substituted imino pharmacophore was therefore extended to appropriately fit the loop D region of the insect nicotinic receptor. Excellent target site selectivity with high insecticidal activity and low toxicity to mammals was achieved rivaling those of the current neonicotinoid insecticides as exemplified by candidate compounds with a trifluoroacetylimino or pyrazinoylimino substituent.

AGRO 124
From vegetated ditches to rice fields: Thinking outside the box for pesticide mitigation

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Innovative mitigation strategies are necessary to address pesticide contamination of surface waters. Since 1998, extensive research has been conducted on the ability of vegetated agricultural drainage ditches to reduce pesticide transport to aquatic receiving systems. Recently, new research has proposed diversion of pesticide-laden drainage water through agricultural rice fields. In two seasonal experiments, diazinon-amended water was diverted through two, 0.5 ha rice ponds, as well as a non-vegetated control pond. Spatial and temporal environmental samples were collected to determine diazinon fate. Outflow diazinon concentrations were significantly ($p<0.05$) decreased from inflow in both vegetated ponds. Although sorption to rice plants was minimal in the overall mass distribution of diazinon (1 – 3%), temporal data indicated diazinon concentrations reached the outflow sediment of the non-vegetated control twice as fast as in either vegetated system. Diversion of pesticide contaminated water through post-harvest rice fields demonstrated potential as a low-cost, environmentally efficient mitigation practice.

AGRO 125
Tools to estimate necessary vegetated ditch BMPs for pesticide mitigation at a watershed scale

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Vegetated agricultural drainage ditches are a potentially important management tool for the remediation of non-point source pesticide pollution in agriculturally dominated watersheds. To utilize ditches as best management practices on a watershed scale, new tools are required to estimate the requisite number and size of vegetated ditches to meet water quality goals. Publicly available spatial and temporal data were used to create a watershed model of Orestimba Creek, California at a scale relevant to pesticide applications and transport. Partitioning coefficients for the adsorption of chlorpyrifos to plants and soils were used to tune vegetated ditch models to address the impact of plant species selection and growth density under several planting scenarios on mass removal of chlorpyrifos. Site suitability analysis techniques were used to rank sites according to their chlorpyrifos application rate, vegetative cover, soil type, and distance from receiving waters, identify the most promising locations for further investigation.

AGRO 126
Effect of riparian vegetation on surface water loading of ground and aerially-applied pesticides in cherry production

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We evaluated the effectiveness of adapted and native woody plant species as drift barriers between cherry orchards and surface water at two sites in Wasco County, Oregon. Spray deposition samplers consisted of filter paper attached to rectangular aluminum frames positioned at 5m above the ground. Five samplers were located along two transects (one intercepted by riparian vegetation) extending from within the orchard towards the creek. Application of malathion ULV was by fixed-wing aircraft. Ground application by tower or standard airblast sprayer used a fluorescent dye as a tracer. Wind speed and direction, and temperature were monitored. In 2006 and 2007 delayed dormant and late season ground applications were evaluated. During June, 2007 two aerial applications at each site were evaluated. Areas without riparian vegetation resulted in higher stream loading estimates. Estimated malathion stream concentrations were compared to adverse effects data for aquatic species.

AGRO 127
Constructed wetlands as a mitigation measure to reduce pesticide loads in agricultural tailwater

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Pyrethroid and organophosphorus pesticides have been found in numerous waterways throughout the United States. Constructed wetlands located in Stanislaus County, CA were evaluated for their potential as a mitigation strategy to reduce pesticide concentrations in return flow. The wetlands were effective at reducing pyrethroid concentrations (52 – 100%) and moderately effective at reducing chlorpyrifos concentrations (52 – 61%), with loads reduced by 95 – 100% in the outgoing water. Effective wetland lengths ($L_{1/2}$) necessary to reduce pesticide concentrations by 50% were estimated to be less than 100 m under low flow, but reaching 267 m under high flow conditions. While most chemicals dissipated less than 1 yr under anaerobic conditions, negligible dissipation was observed *in situ* during the dry season, indicating the potential for persisting between irrigation seasons. The results from this study suggest that constructed wetlands may act as a sink for pyrethroids and can be an effective mitigation measure.

AGRO 128
Efficacy of settlement ponds for reducing pyrethroid runoff in almond orchards

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This study examined the effectiveness of sediment basins for reducing pyrethroid residues in tailwater in two different trials conducted on a section of a large-scale commercial almond orchard in the Central Valley of California. The first

trial was conducted under typical flow conditions with no PAM added to the irrigation water. The second trial was conducted under slightly higher flow conditions with PAM added to the irrigation water at the beginning of the rows resulting in a five-fold reduction in total suspended solids (TSS) entering the sediment basin. Although the use of PAM did not appear to significantly impact the total mass of pyrethroid coming off the field in this study, the sediment basin reduced the total pyrethroid load by 38%-61%. These findings support that the adoption of classical sediment control practices such as sediment basins will reduce the amount of pyrethroid residues in irrigation tailwater released to streams.

AGRO 129
Sediment ponds as a management practice to reduce pesticide runoff in almonds

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Sediment ponds are promoted as a best management practice to help reduce sediment and pesticide runoff from orchards but data on their efficacy is limited. This study tested the efficacy of a sediment pond in reducing the concentrations and total loading of chlorpyrifos in irrigation tailwater. The study site was a 40 acre, flood-irrigated almond orchard near Chowchilla in the San Joaquin Valley, CA. The entire orchard was treated with chlorpyrifos at hull split using an air-blast sprayer. Tail water was sampled from a collection ditch where it entered a sedimentation pond following a post-application irrigation event. Samples were also collected from the pond out-flow for comparison. Samples were analyzed for residues of chlorpyrifos and total suspended solids. Water volume was measured at the inflow and outflow of the pond to determine chlorpyrifos flux. This presentation discusses the suitability of sediment ponds as a management practice for in-season chlorpyrifos applications.

AGRO 130
Management practices for reducing discharge of pyrethroids and sediment in irrigation drainage water

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The use of polyacrylamide (PAM) and sediment basins have long been recognized as effective management practices for reducing pesticide and sediments in drainage water from irrigated agriculture and this has been confirmed by many independent studies. This study examined transport of pyrethroids and sediment from tomato fields under two sets of conditions representing a wide range of sediment transport potential. The study results show that management practices that reduce water and sediment from the field (e.g. PAM and more careful irrigation flow control) and also technologies that remove sediment from edge of field tail waters (e.g. sediment basins) are also effective in reducing pyrethroid transport, with reductions of up to 80 percent demonstrated in these trials.

AGRO 131
Effectiveness of pesticide removal using on-farm vegetated treatment systems and Landguard-op-a

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Vegetated treatment systems (VTS) are designed to reduce pesticide concentrations and toxicity through retention, dilution, sorption, and breakdown in water, sediment, and on plant surfaces. We evaluated the effectiveness of a VTS ditch on a farm in the Salinas Valley. The system consisting of a sediment settling basin, a vegetated section, and a Landguard-OP-A ™ enzyme dosing section. Trials of this system showed incomplete (e.g., 10%) reduction of diazinon in the vegetated section of the ditch, and 100% removal of residual diazinon in the Landguard-treated section. The system also effectively removed turbidity and organochlorine and pyrethroid pesticides from tailwater. There were no reductions in sediment-associated pesticides after treatment with vegetation. The integrated treatment system consisting of a sediment settling section, followed by vegetated and Landguard dosing sections was effective at removing the majority of pesticides and water toxicity from the tailwater runoff. Ongoing studies of this system will be discussed.

AGRO 132
Evaluation of mitigation practices for reducing chlorpyrifos in irrigation run-off from vegetable fields

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Chlorpyrifos is used in cole crop production for control of soil insect pests on the central coast of California. Monitoring data has confirmed that chlorpyrifos concentrations in surface water adjacent to vegetable fields are often toxic to aquatic test organisms. A significant portion of chlorpyrifos may be adsorbed to sediments suspended in irrigation run-off. Granular applications of chlorpyrifos may result in product applied to the surface of the soil where it is susceptible to loss during irrigation events. We conducted a large scale trial in broccoli to evaluate practices to reduce chlorpyrifos concentration and load in sprinkler induced run-off. Polyacrylamide polymer was used to reduce suspended sediments in irrigation run-off, and a liquid formulation of chlorpyrifos was compared with the standard granular formulation. Composite samples of run-off were collected from the plots during 5 successive irrigation events. Bulk water samples were analyzed for chlorpyrifos concentration and suspended sediments.

AGRO 133
Estimating pesticide product volatile organic compound emission speciation based on product composition

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DPR conducted a study to estimate speciation of pesticide products containing high levels of volatile organic compounds (VOCs). Speciation refers to the actual composition of VOCs emitted from individual products. The total volatile portion of a pesticide product was assumed to be the fraction that is volatilized in thermogravimetric analysis (TGA). This volatile fraction is called the product

emission potential (EP). Herein, we describe a procedure for estimating the composition of volatile components from a pesticide product's confidential statement of formula (CSF), compare TGA-measured EPs to CSF-estimated EPs for a large number of products, identify potential problems in determining volatile product components from CSF data, and provide recommendations on ways to improve the CSF and TGA data for emission estimates. This study focused on the top 80 VOC-emitting products in each of 2 years: the 1990 base year and the most recent 2007 inventory year of San Joaquin Valley emissions.

AGRO 134
Pesticide solvents: Ozone formation potential and regional implications

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With the use of a Mobile Ozone Chamber Assay (MOChA), we have been able to assess the ozone formation potential associated with the spraying of solvent based pesticides. We take into consideration the entire suite of VOCs present in the air (from background sources, the spraying vehicle, and the solvent itself). Using photo-chemical modelling, we confirm the amount of ozone formed matched that expected from the diverse VOCs involved. Our results offer perspective for the relative benefit and possible trade-offs in formation changes, as regions of California (and many areas of the United States) strive to meet air quality standards. A leading question which remains is how to include relative reactivity of different VOCs when inventorying emissions and setting goals for their reduction.

AGRO 135
Pesticide solvents: VOC sampling, analysis and ozone formation

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The present study determined the role of pesticide application on airborne VOC concentrations and ozone formation in California. The ozone formation potential (OFP) from the pesticide formulation sprayed on commercial orchards was studied using two transportable smog chambers at four application sites. In addition to the direct measurements of ozone formation, airborne VOC concentrations were measured before and after pesticide spraying using canister and sorbent tube sampling techniques. Soil VOC concentrations were also measured to understand the distribution of VOCs between different environmental compartments. Numerous VOCs were detected in the air and soil samples throughout the experiment but higher molecular weight aromatic hydrocarbons were the main compounds observed in elevated concentrations immediately after pesticide spraying. Measurements indicate that the ozone formation of VOC downwind of the orchard may increase up to 15 ppb after pesticide application with a return back to pre-spray levels after 1 to 2 days.

AGRO 136
Comparison of experimental and computation data for ozone production in California's San Joaquin Valley using updated agricultural emissions profiles

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The global pattern of expanding urban centers and increasing agricultural intensity is leading to more frequent interactions between air pollution emissions from urban and agricultural sources. An excellent example of this interaction is California's San Joaquin Valley (SJV) where new regulations in the SJV restrict emissions of reactive organic gases (ROG) from animal sources in an attempt to meet Federal and State ozone standards designed to protect human health. Previous research has determined more accurate emissions profiles from agricultural animal and feed sources. In order to determine the impact these agricultural sources have on ozone production, the new profiles were utilized to update the source profiles that are given as inputs into a statewide (California) airshed model. The model was used to compare actual ozone production in California for July 2005, 2006, and 2007 versus predicted ozone production during the same period.

AGRO 137
Volatile organic compounds in pesticide formulations: Analysis of volatility and potential contributions to ozone pollution

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Relatively little research has been conducted to examine the environmental fate of pesticide inactive ingredients. This project was designed to address the significant knowledge gaps in concerning potential risks to air quality associated with these compounds. Detailed volatile organic compound (VOC) profiles were determined for six, widely used emulsifiable concentrate pesticide products. Some VOCs are also ozone precursors which has prompted regulatory agencies to limit the VOC release to the atmosphere. The potential volatility of non-active ingredient VOCs in each product was generated using a chemical-specific approach based on the vapor pressure of the compound. This product-specific volatility was compared with results from the prescribed thermogravimetric analysis method from California Department of Pesticide Regulation. In addition, the mass-weighted Maximum Incremental Reactivity Scale of the volatile components of each product was calculated. This approach using specific volatility, mass contribution, and reactivity should provide a more accurate assessment of ozone formation potential of formulants.

AGRO 138
Action of the pyrethroid insecticide decyanoazidofenvalerate on rat $Na_v1.8$ sodium channel expressed in *Xenopus* oocytes

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Effects of decyanoazidofenvalerate (DeCAF) on $Na_v1.8$ were determined using heterologous expression in *Xenopus* oocytes in conjunction with two-electrode voltage clamp techniques. DeCAF treatments produced slowly inactivating late currents carried by $Na_v1.8$ and prolonged tail currents upon repolarization. In the presence of 200 mM DeCAF, the mean tail current decay constant determined from oocytes expressing $Na_v1.8$ was 11.8 ± 2.4 ms. The amplitudes of DeCAF-induced tail and late currents carried by $Na_v1.8$ increased in a concentration-dependent manner. In assays with 200 mM DeCAF, the mean normalized tail and late current amplitudes were 0.16 ± 0.101 and 0.07 ± 0.031, respectively, whereas the values were determined to be 0 in the absence of DeCAF. These findings indicate that DeCAF binds to $Na_v1.8$ expressed in *Xenopus* oocytes and modifies the operation of this channel in a way that is completely consistent with the action of other Type I pyrethroids that cause the T-syndrome.

AGRO 139
Insecticide susceptibility, acetylcholinesterase sensitivity and levels of detoxifying enzymes in field populations of the Asian citrus psyllid, *Diaphorina citri* Kuwayama

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The Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama, is the most important pest of citrus in Florida and around the world. It acts as a vector of three bacterial species in the genus *Candidatus* Liberibacter that are presumably responsible for the most destructive disease of citrus, Huanglongbing (HLB) or greening disease. With the detection of HLB in Florida in 2005, the number of insecticide applications made for suppressing the populations of this insect vector has increased tremendously (6-20 applications/year). As a result, ACP populations are continuously subjected to insecticide selection pressure. In an ongoing study to monitor insecticide resistance in ACP, field populations collected from several locations in Florida were screened for susceptibility to 14 insecticides using topical application bioassay. When compared to a susceptible laboratory population, the susceptibility level of field populations decreased by 1 to 34-fold depending on the insecticide tested. All field populations showed decreased susceptibility to chlorpyrifos (1-18-fold), imidacloprid (6-34-fold) and thiamethoxam (1-12-fold). Biochemical investigations on acetylcholinesterase sensitivity to organophosphate and carbamate insecticides and detoxifying enzyme levels in these populations corroborated the above findings.

AGRO 140
Bioenergy from agriculturally derived solid wastes: Strategies to go beyond corn-derived ethanol

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USDA research in biofuels has embraced an array of topics including optimizing existing biofuels production, developing energy crops, and moving beyond corn-derived ethanol toward lignocellulosics. This presentation addresses specific research programs toward developing commercially-viable conversion of lignocellulosic materials to biofuels by (1) creating improved enzymes for biomass pretreatment, (2) developing value-added products during biorefinery operation, (3) lowering feedstock costs by utilizing a diverse range of under-utilized biomass sources, and (4) improving separation technologies for biorefinery operation. Special emphasis will be placed on LCA discussions related to sustainable use of biomass sources prevalent in the Western States specifically dealing with tight controls on water usage, air pollution, and chemical pollution. Biorefining strategies are applied to diverse feedstocks inlcuding crop residues, energy crops, and municipal solid waste (MSW) with the goal of providing consistent biomass throughout all seasons. The advantages of using sorghum as an energy crop will be discussed as a crop with advantages in the West and Southwest.

AGRO 141
Implementing performance-based sustainability requirements for the low carbon fuel standard: Key design elements and policy considerations

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The rapid expansion of biofuel production may have environmental and social impacts at local, regional, and international levels. In response, many governments (including UK and EU) and international innitiatives (such as the Roundtable on Sustainable Biofuels, RSB) have adopted sustainability requirements for biofuel production. Our study reviews sustainability requirements in other biofuel programs, and discusses key design elements needed for implementing sustainability requirements for California's LCFS and remaining challenges. There has been limited experience in implementing sustainability standards over large geographical and political regions; many technical, policy, and implementation issues remain to be tested. There are remaining policy design challenges to identify appropriate incentives for performance-based requirements for meeting sustainability goals. Despite continued improvement in understanding science and reducing modeling uncertainties, stakeholders should be engaged to discuss ways to create a robust policy framework that will reflect evolving scientific understanding and provide a stable compliance environment.

AGRO 142
Lifecycle water consumption of future transportation fuels: Electricity vs. biofuels

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The problem of water scarcity in California will potentially affect the choice of transportation fuels and technologies that California will adopt to meet its greenhouse gas emissions targets. New low-carbon transportation fuels, such as biofuels, electricity, hydrogen, and unconventional oil, have the potential to use large amounts of water within the State. We build a bottom-up water consumption model to estimate lifecycle water demands of transportation fuels at detailed technology and feedstock level. Our study examines the life-cycle water use for two major future transportation fuel pathways, biofuels and electricity, and discusses how the selection of system boundaries, co-product allocation, water-efficient technologies / management practices will affect the estimates of water demand. We use scenario analyses to demonstrate various pathways to meet California's energy needs by 2020 and their water demands, focusing on the water trade offs of the various pathways.

AGRO 143
Sustainable biofuels: Addressing life-cycle costs, benefits, and impacts

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The world faces significant problems of energy security, agricultural diversification, urban air quality, and global warming. In the search for carbon-neutral alternatives to petroleum, biofuels have emerged as a technologically feasible option, particularly the cellulosic or algal biofuels. However current methods to measure, evaluate, and regulate the ecological and human health impacts and benefits of biofuels are inadequate. To enable a process that provides more insight for these complex choices, this presentation describes research to anticipate the nature and magnitude of the changes that arise from large-scale deployment of biofuels. We will evaluate how and how well life-cycle impact assessment (LCA) addresses life-cycle cost, carbon footprint, ecological damage, and human health burdens at each of the biofuel life stages--feedstock production, biofuel production, transportation and storage, and fuel use. The presentation concludes with consideration of key uncertainties and information gaps and how this can and should drive future research.

AGRO 144
Fast pyrolysis of guayule biomass

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The sustainability of industrial crops like guayule, a domestic source of natural rubber, can be significantly enhanced by utilization of biomass residues. Guayule bagasse, a free-flowing solid, presents an attractive bioenergy feedstock due to its high energy content, small particle size, and high density. Moreover guayule is harvested year-round providing a continuous source of feedstock. One option for feedstock conversion is fast pyrolysis. Guayule bagasse and whole shrub was converted into bio-oil, charcoal, and non-condensable gases by fast pyrolysis at ~ 500°C in a bench-scale fluidized bed reactor. Over a sand medium, bio-oil was produced in the 60% yield range without catalyst. Bio-oils from guayule had energy content around 30 MJ/kg, 75% of the value of heavy fuel oil. The energy content of guayule was determined based on Py-GC/MS pyrograms, and the contributions of natural resin and rubber components quantified. The stem-derived latex-extracted bagasse contained the highest thermochemical energy potential.

AGRO 145
Rice straw utilization studies for biofuels production

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More than 1.2 million tons of rice straw are produced in California every year and environmental regulations restrict the burning of rice straw. Farmers manage their rice straw mainly by soil incorporation and baling, both of which add significantly to operating costs. Several viable alternatives exist including animal feed and bedding, erosion control, and building materials, however these outlets consume only 3-5 % of the total rice straw produced. USDA-ARS in Albany, California is exploring the feasibility of rice straw as a participant feedstock in the integrated biorefinery concept. The integrated biorefinery is based on municipal solid waste as the main feedstock accepting local seasonal ag-wastes to generate biofuels. Rice straw hydrolysis and fermentation to ethanol after hot water pre-treatment studies will be presented. Additionally, anaerobic digestion of rice straw to methane will be presented. The integrated biorefinery approach responds to the need for cost effective biofuels from non-food sources giving rice farmers another option for rice straw disposal.

AGRO 146
Large-scale advanced biofuel implementation: A case study of Illinois and Indiana

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There is much talk today about introducing biofuels in the United States and in the world. It is clear that the best, most defensible policies will have to employ the precautionary principle, and stay away from converting food crops into fuels in order to avoid not just harming the environment but also disrupting food and feed markets. The next generations of biofuels will come from converting lignocellulosic plants. The details of how are emerging now. One of the critical issues is producing biofuels environmentally and economically efficiently on a large scale. We present a case study of Illinois and Indiana, states that could grow biomass, convert it into fuels, and supply their needs from local sources. We calculate the greenhouse gas footprint of this scenario, and account for the human health effects of this large-scale change in fuel provision relative to the existing petroleum refining industry.

AGRO 147
Glyphosate-resistant weeds in glyphosate-resistant crops vs. non-glyphosate-resistant crops

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The use of glyphosate in glyphosate-resistant crops has been extremely valuable in controlling existing herbicide-resistant weeds that evolved resistance in conventional crops. Glyphosate provides excellent control of ALS inhibitor, ACCase inhibitor, and triazine resistant weeds that had become serious problems in corn/soybean rotations and cotton production. However over reliance on glyphosate for weed control led to a rapid increase in the number of glyphosate-resistant weeds (16 globally). Whilst *Conyza canadensis* is the most widespread glyphosate-resistant weed, glyphosate resistant pigweed species, in particular *Amaranthus palmeri* and *Amaranthus rudis*, pose the biggest threat to the sustainability of glyphosate-resistant crops. Other serious threats are posed by *Ambrosia spp.*, *Lolium spp.*, and *Sorghum halepense*. The sustainability of both conventional and glyphosate-resistant crops is dependent on rotation of herbicide modes of action in conjunction with integrated weed management practices.

AGRO 148
Mechanism of resistance of evolved glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*)

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We investigated the resistance mechanism in glyphosate-resistant Palmer amaranth from Georgia, USA, in comparison to normally sensitive populations. We measured relative copy numbers of the 5-enolpyruvyl shikimate-3-phosphate (EPSPS) gene using quantitative PCR. Genomes of resistant plants contained from 5-fold to over 160-fold more copies of the EPSPS gene than did genomes of susceptible plants. EPSPS expression in cDNA and EPSPS protein level were both positively correlated with genomic EPSPS relative copy number. EPSPS gene amplification was heritable, correlated with resistance in pseudo-F_2 populations, and is proposed to be the molecular basis of glyphosate resistance. Fluorescent in-situ hybridization (FISH) was used to visualize the location and size of the EPSPS gene amplification. The FISH images indicated that the EPSPS gene occurs on multiple chromosomes, suggesting that a transduplication has occurred. This is the first known occurrence of gene amplification as an herbicide resistance mechanism in a naturally occurring weed population.

AGRO 149
Herbicide resistances in waterhemp (*Amaranthus tuberculatus*): A call for new options

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Waterhemp is a troublesome agronomic weed of the midwestern United States that has demonstrated a propensity to evolve herbicide resistance. Herbicides or herbicide groups to which resistance has been documented in waterhemp are triazines, acetolactate synthase (ALS) inhibitors, protoporphyrinogen oxidase (PPO) inhibitors, and glyphosate. Waterhemp's obligate outcrossing (owing to its dioecism) results in accumulation of multiple resistance traits within single populations, and even within single plants. The presence of such multiple-resistant waterhemp populations leaves crop producers with few effective herbicide options, particularly for postemergence control in soybean. In fact, the recent history of postemergence herbicides in soybean shows a recurring scenario, in which waterhemp evolves resistance to the primarily used herbicide or herbicide group (first ALS inhibitors, then PPO inhibitors, now glyphosate). In all likelihood, this history will continue to repeat. Thus, whether obtained by conventional or biotechnological means, new herbicide options will be needed to manage waterhemp.

AGRO 150
Glyphosate metabolism in glyphosate-resistant crops and weeds vs. susceptible crops and weeds

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Accumulation of aminomethylphosphonic acid (AMPA), the main glyphosate metabolite, has been found in glyphosate-treated, glyphosate-resistant (GR) soybean, apparently due to plant glyphosate oxidoreductase (GOX). AMPA is mildly phytotoxic, and under some conditions the AMPA accumulating in GR soybean correlates with glyphosate-caused phytotoxicity. A bacterial GOX is used in GR canola, and an altered bacterial glyphosate *N*-acetyltransferase is planned for use in a new generation of GR crops. In some weed species, glyphosate degradation could contribute to resistance. However, a plant GOX enzyme has not yet been reported in plants. Gene amplification of plant GOX or transfer of microbial genes for glyphosate-degrading enzymes could produce GR weeds. Yet, there is no evidence that metabolic degradation plays a significant role in weed resistance to glyphosate. The lack of evidence of metabolic degradation of glyphosate as a resistance mechanism in GR weeds us puzzling, considering the tremendous selection pressure of glyphosate on weeds.

AGRO 151
Environmental impacts of transgenic glyphosate-resistant soybean cultivation in Brazil

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Glyphosate-resistant soybeans (GRS) effects on contamination of soil, water, and air are minimal, compared to those caused by the herbicides that they replace when GRS are adopted. Transgenes encoding glyphosate resistance in soybeans are highly unlikely to be a risk to wild plant species in Brazil. GRS resulted in a significant shift to no-tillage practices, but weed resistance may reduce this trend. Probably the highest agricultural risk in adopting GRS in Brazil is related to weed resistance due to use of glyphosate. Weed species in GRS fields have shifted in Brazil to those that can more successfully withstand glyphosate or to those that avoid the time of its application. These include *Chamaesyce hirta*, *Commelina benghalensis*, *Digitaria insularis*, *Spermacoce latifolia*, *Richardia brasiliensis*, and *Ipomoea* spp. Four weed species, *Conyza bonariensis, Conyza Canadensis*, *Lolium multiflorum*, and *Euphorbia heterophylla*, have evolved resistance to glyphosate in GRS in Brazil. *Conyza* spp are the most difficult to control.

AGRO 152
Gene flow: It's not just for transgenes
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Gene flow was raised as one of the most important issues beginning with the first discussions about the development and release of genetically engineered crops. Gene flow has remained a topic of discussion for more than 20 years and is still used as an argument against the release of transgenic crops. With respect to herbicide resistant crops, gene flow does not differ whether the herbicide resistance trait is due to a transgene or is due to genes produced via conventional breeding techniques. Conventional breeding and genetic engineering techniques have been used to produce herbicide resistance in many of the same crop species. In addition, conventional breeding has been used to produce herbicide resistance in species that have not been genetically engineered. Economic, political, and social concerns may center on the breeding technique but the results of gene flow for weed management are the same irrespective of breeding technique.

AGRO 153
Use of environmental fate processes to mitigate pesticide impacts on urban water quality

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In California, the Sacramento River is a major water source for both the City of Sacramento and nearby rice production. An herbicide-intensive industry, there is concern regarding residue input following rice field drainage. Therefore, agents proposed for use must have fate properties favoring rapid dissipation from field water prior to release. Penoxsulam (Granite) is a relatively new triazolopyrimidine sulfonamide herbicide increasingly used by rice growers. Therefore, its dissipation from field water was modeled by characterizing its fate via volatilization, soil sorption, microbial degradation and photodegradation. A water-soluble agent, its calculated Henry's law constant indicates it is essentially non-volatile; Freundlich coefficients also indicate it is minimally sorptive. However, it is rapidly degraded via sunlight or anaerobes (pseudo-first order half lives ranging 3-10 days). Therefore, under California rice field conditions penoxsulam is likely to dissipate to non-detectable levels prior to field drainage, thus posing no significant impact to Sacramento River water quality.

AGRO 154
Comparison of agricultural run-off between organic farming and conventional chemical farming

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Monitoring of organic and conventional walnut orchard runoff in the Central Valley of California examined alternatives that benefit the growers, the consumer, and the protection of water quality. Grants from the California State Water Resources Control Board (SWRCB) were being used for outreach, education, and technical support for growers trying alternatives to synthetic pesticides and fertilizers and starting organic farming practices. Best Management Practices (BMPs) that were being implemented included organic pesticides and pheromone disruption, cover crops, filter strips, beneficial insects, and monitoring of insects and their fertility. The San Francisco Estuary Institute conducted water and sediment quality monitoring with the goal to evaluate potential differences in pesticide and nutrient concentrations running off from various organic and conventional orchards. Preliminary results quantified load reductions of pesticides draining into streams and rivers listed on the 303d List for impaired water bodies. Specifically, concentrations of diazinon, and several pyrethroids in water as well as in sediment showed drastic differences when compared between the different growing practices. This work allows the assessment of effectiveness of BMP implementations in combination with data collected from the County Agricultural Commissioners and pesticide use reports.

AGRO 155
Targeting adoption of BMPs to farmlands adjacent to impaired waterways using GIS mapping and grower visits

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Central Valley watershed coalitions are responsible for identifying sources of farm inputs in surface water then encouraging growers to adopt BMPs should their practices lead to impairments of water quality. Water sampling by the East San Joaquin Water Quality Coalition (ESJWQC) since 2005 identified 22 waterways in the region with exceedances likely caused by farm inputs. The ESJWQC in 2009 used a prioritization process to work with its members. Three waterways with the highest frequency of pesticide exceedances were selected for a outreach. GIS mapping identified coalition parcels adjacent to the priority waterways. Pesticide Use Reports were examined to determine if members used pesticides found in sampling. Coalition representatives visited 100% of their members along the priority waterways. Discussed were their existing farming practices and BMPs for mitigating potential problems. Water sampling in the priority watersheds between March 2009 and August 2009 found only one exceedance of the targeted pesticide.

AGRO 156
Testing the effectiveness of the dormant spray regulations, the diazinon dormant spray label restrictions, and current and future technical advances to reduce diazinon surface water runoff

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The federal Clean Water Act required each State to identify waters within their boundaries that did not meet water quality standards set for beneficial use. The Sacramento, Feather and San Joaquin Rivers were listed as impaired by diazinon. This presentation describes the registrant's efforts to reduced surface water runoff of diazinon through dormant spray regulations, EPA label changes, development of management practices for applications and other techniques to effectively reduce runoff. The effect of the mitigation program was validated through review of statewide surface water data for the Sacramento, Feather River, and San Joaquin Watersheds 2001-2007. Based on regression analysis of annual mean values, temporal data for the three mainstem sites showed a consistent declining trend in diazinon concentrations from 2002-2007, and the various trend analyses all point to declining diazinon concentrations and significant reductions in the diazinon target exceedances for the three watersheds.

AGRO 157
Introduction of atrazine-degrading *Pseudomonas sp.* strain ADP to enhance rhizodegradation of atrazine

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Vegetative buffer strips (VBS) has been proven to be one of the most cost-effective mitigation practices for removing atrazine (ATR) from surface runoff derived from agronomic operations. However, the mineralization of ATR and its chlorinated metabolites or complete cleavage of the triazine ring in the rhizosphere was limited to less than 2-10% under both laboratory and field conditions. Despite the persistence of ATR and its degradates, a few bacteria strains including *Pseudomonas* sp. ADP containing a series of degradation genes could rapidly mineralize ATR and its degradates into CO2. The addition of ATR biodegrading bacteria Pseudomonas sp. strain ADP into established VBS to degrade the entrapped ATR is a promising mitigation approach. We investigated the synergistic effect of introducing these biological agents to enhance the rhizodegradation of ATR. The results suggested that the degradation activities and population of *Pseudomonas* sp. ADP can be sustained by specific plant species.

AGRO 158
Enzyme enabled remediation of pesticide residues

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There are increasing concerns from both regulators and consumers around the world about residues of synthetic pesticides and herbicides in environmental and potable water and on horticultural commodities. A variety of remediation strategies have been tried, with variable levels of success, depending on the specifics of the contamination problem. However there have been no satisfactory remediation solutions for removing residues from contaminated waters, such as can be generated in the run-off from irrigated agriculture, animal and commodity dips etc. To address this need we have been developing a free-enzyme bioremediation technology which uses the catalytic efficiency and specificity of certain enzymes to deliver cost effective contaminant detoxification. Unlike other (microbial) bioremediation technologies, free-enzyme bioremediation is not dependent upon the growth of intact organisms, so the rate of detoxification is directly linked to the catalytic properties of the enzyme employed and the concentration of enzyme applied. Equally, the lack of reliance on whole organisms allows the use of modern enzyme engineering techniques to optimise the enzymes for the purpose, without requiring the release of genetically modified organisms. We have developed enzymes for several pesticides and herbicides and shown them to be fit for purpose in large-scale field trials. The first of them, for organophosphate insecticides, is now being used commercially in some jurisdictions. We will summarise some of the key technical and commercial issues involved in developing and deploying free-enzyme bioremediants for a range of applications.

AGRO 159
Pesticide occurrence in U.S. homes: Research design for The National Children's Study

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The National Children's Study (NCS) is a multi-year longitudinal cohort study that will examine the effects of environmental influences on the health and development of more than 100,000 children across the Unites States. The NCS will follow participants from before birth to age 21. As part of an effort to quantify children's potential exposure to pesticides within residential settings, surface wipe samples will be collected from the most used room within the homes of study participants. Samples will be analyzed for select pesticides commonly used in and around dwellings and will include pyrethroid, organophosphorous, and organochlorine compounds. The NCS study design, surface wipe media selection, sample collection methods, analytical method and preliminary results from the NCS Vanguard feasibility study will be presented.

AGRO 160
Urban pesticide exposure: Observations from the California Pesticide Illness Surveillance Program

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Since the 1980s, the California Pesticide Illness Surveillance Program has collected information on health effects that develop following pesticide exposure. A series of incident reports demonstrates the potential for agricultural pesticides to affect urban neighborhoods. Fumigants with irritant properties, specifically chloropicrin and MITC, are prominent. We relate application rates and methods, atmospheric conditions, and topography to development of symptoms among nearby residents and workers. Air concentration modeling shows close correspondence between reported symptoms and likely air levels. For most of its existence, data availability has biased the program towards occupational and agricultural exposures. Recently, cooperation with the California Poison Control System has provided access to information on an unprecedented number of non-agricultural, non-occupational (predominantly residential) exposures. We characterize typically urban exposures with respect to the products implicated, the activities and manner of exposure of the people affected, and the types of effects experienced.

AGRO 161
Pest management and pesticide use in California child care centers

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The California Healthy Schools Act requires child care providers to use Integrated Pest Management (IPM) techniques to control pests and to notify parents about pesticide use. We surveyed 637 child care centers about pest management and pesticide use. Eighty-nine percent reported pest problems; 55% reported using pesticides, with 47% using sprays or foggers that are more likely to expose children and staff. In contrast, fewer centers (21%) reported using low-exposure pesticide application methods such as baits. Twenty-nine percent reported that pesticide applications occurred once or a few times a year; 20% were applying pesticides on a weekly or monthly basis. Up to half of the child care facilities were not properly notifying parents about pesticide use, and only 25% reported knowing what IPM was. These findings underscore the need for outreach to ensure child care providers have the tools to manage pests using pesticide alternatives and low exposure application methods.

AGRO 162
Non-crop IPM programs and a proposal to incorporate pesticide exposure potential into the management scheme

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Integrated Pest Management (IPM) in and around buildings involves long-term strategies for controlling pest problems through a combination of techniques including monitoring, sanitation controls, and structural designs to minimize pest habitats. Pesticides play an important role in IPM programs when they are needed based on pest presence and pressure. The product selection criteria for many IPM programs involve a hazard-based approach to pesticide selection. The IPM manager is frequently mandated to make selection decisions that require knowledge of signal words, reproductive toxicity, carcinogenicity, neurotoxicity, and endocrine disruption potential of active ingredients as well as inert ingredients. Such a requirement can be daunting if not impossible. A proposal to redirect this emphasis on hazard to an emphasis on exposure using knowledge of application methodologies, sites of application, application timing, and formulation types to minimize risk is presented as a more practical management strategy.

AGRO 163
Use of Vikane® gas fumigant (sulfuryl fluoride) for eliminating bed bugs (*Cimex lectularius*) infesting structures and furnishings

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Vikane® gas fumigant (99.8% sulfuryl fluoride [SF]) has been used for nearly fifty years in the US to fumigate more than 2 million buildings for control of structure-infesting pests. The global pandemic of bed bugs (*Cimex lectularius*) has resulted in renewed commercial applications of SF for control of this cryptic pest. Recent research has confirmed that all life stages of bed bugs are effectively controlled by prescribed dosages. SF has multiple benefits for bed bug control. It results in no residues of toxicological concern in fumigated items. SF can be used to fumigate items, including mattresses, clothing, toys, and electronics, which other treatments may damage or may not be approved for application. There is no known resistance of bed bugs to SF. Dosage accumulation of SF can be easily measured to ensure a lethal dosage is obtained. SF penetrates throughout the treated space more reliably than do other treatments to kill bed bugs.

AGRO 164
Design and development of an "Always Active" termite baiting system

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It is intuitively obvious that an effective termite baiting system, in which an active ingredient of low mammalian toxicity is applied in small quantities within a confined bait station, is inherently less likely to result in human exposure than tens to hundreds of gallons of a dilute liquid termiticide applied to the soil around a structure. Economic considerations for the pest management professional, however, have limited adoption of termite baiting and prevented its becoming a dominant method of termite control. This presentation describes the evolution of the Sentricon system as an alternative to liquid termiticide applications and details the laboratory and field efficacy data leading to the recent federal registration of Recruit HD, a durable termite bait designed to enable a significant improvement in applicator efficiency through an annual service interval. It discusses attributes of the product that may improve the adoption of a reduced-exposure technology in an economics-driven urban environment.

AGRO 165
Exploring insecticide neurotox and detox

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The major insecticides are neurotoxicants with their safety for people and the environment dependent on their selective toxicity and rates of detoxification. Explorations of the Environmental Chemistry and Toxicology Laboratory (ECTL) at the University of California in Berkeley and the University of Wisconsin in Madison therefore focused on neurotox and detox. Insecticides acting on the nervous system teach us much about the diversity of nature and survival in a toxic environment. Knowledge of insecticide comparative metabolism in insects, mammals, and plants, an ECTL specialty, exceeds that for any other type or class of chemicals. Insecticide-related compounds discovered or pioneered in the ECTL include saligenin cyclic phosphates, bicyclophosphates, polychlorobornanes, trioxabicyclooctanes, dithianes and ryanodine analogs. ECTL radioligands such as azidoIMI, CA, CPO, DHR, EBOB, EPI, IMI, OBDPO, TBOB, TBPS, and TDP have helped characterize many insecticide targets. The studies continue with 21st century insecticides diverse in mechanisms and chemical types as required for crop protection and public health.

AGRO 166
Development of novel sarin surrogates and novel blood-brain barrier-penetrating oxime antidotes to organophosphate inhibition of acetylcholinesterase

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Prolonged inhibition of brain acetylcholinesterase by some organophosphates, such as the nerve agents, can lead to seizures and brain damage. Current oxime reactivators, such as 2-PAM, cannot enter the brain and therefore cannot prevent seizures. Novel highly relevant sarin surrogates were developed, which leave acetylcholinesterase phosphorylated with the same chemical moiety as sarin. Phthalimidyl isopropyl methyl phosphonate (PIMP) is useful in vitro because it is relatively unstable and prevents reinhibition of reactivated acetylcholinesterase. Nitrophenyl isopropyl methyl phosphonate (NIMP) is sufficiently stable to be usable in vivo. A series of novel oximes yielded a range of efficacies as reactivators of rat brain acetylcholinesterase inhibited by PIMP, with a few approaching the efficacy of 2-PAM. The most efficacious were tested *in vivo* in rats treated with a high sublethal dosage of NIMP, and at least 6 have shown brain acetylcholinesterase reactivation up to 35%. Support: Defense Threat Reduction Agency 1.E0056_08_WR-C.

AGRO 167
Molecular interactions of highly selective carbamates with acetylcholinesterase of the malaria mosquito, *Anopheles gambiae*

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Anticholinesterase insecticides are generally considered to have poor selectivity at the target site, due to absolute conservation of the catalytic site residues across different species. In the malaria mosquito, *Anopheles gambiae*, the ace-1 gene codes for acetylcholinesterase (AChE). Classical inhibitors of this enzyme (e.g., carbamates and organophosphates) display little selectivity for enzyme inhibition, typically < 4-fold, compared to human. Recent studies in our laboratories identified carbamates having 100- to 1000-fold selectivity for malaria mosquito AChE compared to human AChE. These compounds also have reduced activity against other non-target vertebrates, honeybee, and certain agricultural pests. Molecular modeling efforts suggest that the mosquito enzyme is able to accommodate aryl carbamates with bulky substituents due to flexibility in the position of Trp84. These new molecules have unprecedented potential as leads to safe, effective mosquitocides in the fight against malaria.

AGRO 168
Butterflies to blood pressure with JEC: The soluble epoxide hydrolase as a target for treating diabetes, hypertension, inflammation and pain

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John Casida has a talent for inventing new fields. From just the 4 years we shared with John in 1969-73, the ramifications of initial discoveries made in his laboratory are daunting. One example of his innovation is the path from studying insect juvenile hormone and a mimic being developed as a pesticide to a pharmaceutical in clinical trials. In this work we found that a major route of metabolism in multiple insect species of the hormone and its mimic was by epoxide hydration. Epoxide hydration was important in mammals, but the enzyme was a soluble epoxide hydrolase at a time when the enzyme was thought to be exclusively microsomal. Years later inhibitors of this enzyme have just completed phase II clinical trials for hypertension in obese diabetics. The insect control project which started in John's lab has yielded promising materials to treat pain, inflammation, blood pressure and other disorders.

AGRO 169
Annotating the role of monoacylglycerol lipase in the brain and in cancer

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Monoacylglycerol lipase (MAGL) is most widely known for its role in hydrolyzing the endocannabinoid 2-arachidonoylglycerol (2-AG). Recent studies have brought to the forefront organophosphorus (isopropyldodecylfluorophosphonate) and carbamate (JZL184) MAGL inhibitors that are potent and efficacious in vivo. Selective blockade of MAGL leads to elevations in brain 2-AG levels and cannabinoid-mediated antinociception. Since arachidonic acid is the major precursor to the proinflammatory class of eicosanoids, blockade of MAGL may also lower eicosanoid signaling and elicit anti-inflammatory effects in the brain. Further studies show that MAGL is upregulated in multiple types of aggressive human cancer cells where it regulates a diverse fatty acid network enriched in protumorigenic lipid signaling molecules. MAGL blockade leads to impairments in cancer cell migration, cell survival, invasion, and in vivo tumor growth. MAGL inhibitors may therefore serve as promising therapeutics for pain, neuroinflammation and cancer, by nodally controlling multiple lipid signaling pathways.

AGRO 170
Teratogenesis of organophosphorus insecticides (OPI) in chicken embryos linked to diminished NAD^+: OPI structural requirements and altered protein expression

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Some OPI induce micromelia and abnormal feathering in chicken embryos characterized by a reduction in embryonic NAD^+. A selective inhibition of yolk sac membrane kynurenine formamidase was proposed to be the cause of NAD^+ diminished synthesis. Our extended investigation on

NAD-related organophosphate-induced teratogenesis focused on two areas: First, the 3D quantitative structure-activity relationship analysis defined molecular features that determine OPI in ovo inhibitory potency toward yolk sac membrane kynurenine formamidase. The electrostatic and steric fields were the best parameters to correlate structures of organophosphates with their potency to inhibit in ovo kynurenine formamidase. Second, in yolk sac membranes, a potent OPI chicken teratogen diazinon altered expression of procollagen-proline dioxygenase and several other proteins of muscle and connective tissues. Embryo malformations produced in NAD-related organophosphate-induced teratogenesis may result from the altered biosynthesis of those proteins.

AGRO 171
Spiroindolines reveal a novel target protein for insecticide action

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Spiroindolines, an exploratory insecticide class, were shown to induce coiling symptomology in the nematode *Caeorhabditis elegans*, which is characteristic of some genetic lesions affecting neuromuscular function. A genetic screen identified mutations giving rise to resistance which mapped to a single gene. Overexpression of wild type or variant forms of the homologous gene in *Drosophila melanogaster* also conferred resistance to Spiroindolines. Expression of this gene in cell culture generated a high affinity binding site for Spiroindolines with characteristics very similar to that seen in insect tissues. For active analogues the insecticidal activity has been shown to be associated with potent inhibition of the function of this novel insecticide target.

AGRO 172
Abiotic reduction of dichloroacetamide safeners: Transformations and fate of "inert" agrochemical ingredients

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Safeners are "inert" ingredients used to protect crops from the toxic effects of herbicides. Herein, we report on the transformations of dichloroacetamide safeners (*e.g.*, benoxacor and dichlormid) in laboratory suspensions of Fe(II) sorbed on goethite. Kinetic studies reveal that dichloroacetamides are readily reduced to monochlorinated compounds with structures resembling herbicide active ingredients, including one formerly-used herbicide (CDAA). Our results indicate that abiotic reactions may influence the fate of safeners in iron-reducing environments, including saturated soils, sediments and aquifers.

AGRO 173
Evaluation of novel insecticide (Proteus 170 O TEQ) for the routine protection of cocoa farms against the brown cocoa mirid (Sahlbergella singularis) in Nigeria

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The mortality rates of mirids on exposure to the various concentrations of Proteus and Standard miricide in the laboratory were similar at 0.46% concentration as both gave a 100% kill of mirids at the 40th minute. The first year field mortalities of mirids recorded 24 hours after the initial and residual applications at the Ibadan, Owena and Ikom at 0.46% active ingredient concentration gave 100% kill of mirids. The mortalities of mirids recorded 24 hours after the second year field initial and residual treatments at the lowest concentration of 0.15% active ingredient ranged between 70.2% and 100%. In the third year, the insecticide at 0.31% concentration compared favourably with the Standard.The residues of thiacloprid in the analyzed cocoa bean samples were below the Limit of Quantitation of 0.01 mg/kg. Spraying of mature and fruiting cocoa farms at application rate of 0.46% was found adequate and recommended.

AGRO 174
Uptake of 17α-ethynylestradiol and triclosan into plants

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Recently, several studies and media accounts have described the occurrence of pharmaceuticals and personal care products (PPCPs) in the environment. Since residual concentrations of PPCPs (from both human and agricultural uses) can be found in soils, these compounds could be taken up by plants which represent a potential exposure route to humans. In this study, pinto beans, *Phaseolus vulgaris*, were used to determine uptake of EE2 and triclosan from sand spiked weekly with these compounds at 1µg/g. Plants were extracted and analyzed using HPLC methods developed for PPCPs. Initial results indicated that EE2 and triclosan are accumulated in roots up to 1.3 mg/g dry weight and 2.2 mg/g dry weight, respectively. In leaves, EE2 and triclosan can be detected at concentrations up to 24 µg/g dry weight and 2.6 µg/g dry weight, respectively. Synthetic estrogens and antimicrobial/antibiotic compounds in runoff have the potential to be taken up by vegetation.

AGRO 175
Experimental evidence for allosteric solvent effects between mosquito-selective carbamates and the malaria vector, A*nopheles gambiae*

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To control the malaria vector, *Anopheles gambiae* (*Ag*), we have developed several phenyl substituted *N*-methylcarbamates that display a high degree of selectivity ($\geq$1000-fold) over human acetylcholinesterase (AChE). Selectivity data was originally obtained using EtOH as the solvent during the screening process. Re-screening of these carbamates in the presence of 0.1% DMSO (*v*/*v*) resulted in higher IC_{50}s for *Ag*AChE, thus reducing the *Ag*AChE-selectivity by at least 10-fold. However, the presence of DMSO did not antagonize the inhibition of human, *Drosophila*

melanogaster, or *Musca domestica* AChE. No antagonism of inhibition was observed toward any species studied (including *Ag*AChE) with non-selective carbamates or when EtOH was used as a solvent. Molecular models provide an explanation for antagonism of inhibition when DMSO is present, and the implications for high throughput screening will be discussed.

AGRO 176
DDA excretion in chickens following low level DDT feeding

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Dietary DDT exposure leads to a rapid formation of DDA, [*bis*(*p*-chlorophenyl)acetic acid, CAS# 83-05-6], a water-soluble metabolite in chickens. Chickens were fed 10 and 100 ppm DDT for 8-day intervals each following 8-day control periods. Chicken blood and feces were analyzed for both DDT/DDD/DDE and DDA. DDT blood levels were below the method limit of detection (1 ppb) at 10 ppm DDT. DDA levels in feces have ranged from 5 to 25 ug/d in 2 studies at 10 ppm DDT. At the higher excretion level, DDA accounted for about 2% of the ingested dose. In previous unpublished research in rhesus monkeys (100 ppm DDT in diet; Clark 1977) urinary DDA excretion was estimated at 2-6% of dietary DDT. DDA may be a useful general biomarker of active DDT exposure in many organisms including chickens and other birds.

AGRO 177
Evaluation of new carbamate insecticides for neurotoxicity to non-target species

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Because of increasing resistance of vector mosquitoes *Anopheles gambiae* to pyrethroids and high mammalian toxicity of existing anticholinesterase insecticides, malaria control needs new compounds. We used AChE from 6 non-target species to test and compare the potential toxicity of new carbamates we are developing. By comparing in vitro AChE inhibition capacity (IC_{50}), the new carbamates show good selectivity over *Anopheles gambiae*, which ranges from 0.47- to 20,000-fold compared to vertebrates we screened, while that of commercial carbamates is from 0.3- to 5.6-fold. Next, bimolecular inhibition constant (k_i) data shows that the average k_i from commercial carbamate group is 17-fold greater in non-target species than that of the new carbamate group. In addition, in vivo aquatic toxicity by using live *Daphnia magna* suggests less environmental impact of the new carbamates. The overall results show that these compounds possess improved properties in malaria vector control.

AGRO 178
Simultaneous analysis of sulfonamides, tetracyclines, and free and conjugated estrogens in an agricultural watershed by LC/MS/MS

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The study of estrogens, sulfonamides, and tetracycline continues to gain interest due to their persistence and impact in the environment. This work documents the development of a single analysis able to quantify hormones (free and conjugated estrogens) and antibiotics (sulfonamides and tetracyclines) by LC/MS/MS. Ionization of compounds were achieved by switching positive/negative mode electrospray at a high pH mobile phase. The single analysis eliminates the need for two separate analyses and reduces overall analysis time, which allows for a more cost effective risk assessment. A tandem solid phase extraction technique is used to extract, concentrate, and clean-up aqueous matrices. Accelerated solvent extraction is used in conjunction with solid phase extraction for soils. Application of this method targets the study of fate, persistence, transport, and potency of hormones and antibiotics in an agricultural watershed subjected to poultry litter applications.

AGRO 179
Residue dynamics of procymidone in leeks and soil in greenhouses by smoke generator application

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A modified QuEChERS-GC-MS method for procymidone residue analysis in leeks and soil was developed and validated. Procymidone residue dynamics and residues in supervised field trials in leeks and soil in greenhouses were studied. Leek samples were treated under microwave radiation for 1 min before homogenization, followed by extracting with acetonitrile and clean-up with reverse solid phase dispersion by primary and secondary amine. Procymidone residue was determined by GC-MS in SIM mode. At four geographical experimental plots, procymidone residue in leeks and soil showed a relatively fast dissipation rate, with half-lives of 4.52–8.76 days for leeks and 3.76–5.65 days for soil. At pre-harvest-intervals of 21–30 days, procymidone residue ranged from 0.033 to 0.17mg/kg in leeks, and 0.020–1.75mg/kg in soil. Residues persistence varied in leeks and soil in four field trials, suggesting that it might be affected by some physico-chemical factors, growth dilution factor, soil characteristics and microorganisms.

AGRO 180
Rubber latex gloves as a potential dermal dosimeter for measuring multiple pesticide residues in strawberry harvesters

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Potential harvester pesticide exposure (µg/d) may be expressed as dislodgeable foliar residues (DFR, µg/cm^2) x strawberry harvester transfer coefficient (cm^2/h) x hours/d. We are interested in the available part of the DFR. Our overall goal is to develop a simple, clear and reliable indicator of strawberry harvester exposure to multiple pesticide residues. Latex gloves were randomly collected as they were discarded by harvesters at strawberry farms in Santa Maria, CA. Multiple insecticide, fungicide and miticide residues have been detected in ethyl acetate extracts of gloves worn for 2 to 2.5 h work periods. Levels ranged from 3 to 3000 ug/pair. Since hands are the primary route of exposure, it will be important to determine the relationship between the residue retained on gloves and potential dermal exposure. Because gloves are regularly changed during the work day, they may be a dosimeter for continual measurement of dermal exposure.

AGRO 181
Serial invasive signal amplification for the determination of *kdr* allele frequencies in global human head louse populations for efficient resistance monitoring

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Three point mutations (M815I, T917I, and L920F) in the para-orthologous voltage-sensitive sodium channel α-subunit gene of the head louse are associated with head lice resistance to pyrethrins and pyrethroid-based insecticides due to target site insensitivity known as knockdown resistance (*kdr*). Serial invasive signal amplification reactions (SISAR) have been developed to detect *kdr* allele frequency and to determine the allelic zygosity in individual head lice from field populations collected from 14 countries on 6 continents in order to construct a worldwide *kdr* map. *Kdr* alleles are wide spread but not yet uniform worldwide. Developed countries with more local access to over-the-counter pyrethroid pediculicidal products tend to have high instances of *kdr*. Overall, the worldwide *kdr* allele frequency is 58.6%. Using SISAR, resistance-conferring mutations are detected in a high throughput format, facilitating the efficient monitoring of pyrethroid resistance allele frequency in field populations.

AGRO 182
RNAi knockdown of ABC transporters causes decreased tolerance to DDT in the highly DDT-resistant *91-R* strain of *Drosophila melanogaster*

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Resistance to dichlorodiphenyltrichloroethane (DDT) in the DDT-resistant *91-R* strain of *Drosophila melanogaster* is extremely high compared to the susceptible strain, *Canton-S* (>1000 times). Previously, Decreased penetration (30%), increased metabolism (15%), and increased excretion (5-times) of DDT were determined in *91-R* compared to *Canton-S*. The present study determines the role of Phase III metabolism involving ABC transporters in the excretion of DDT by *91-R*. Pretreatment with the p-glycoprotein inhibitor, verapamil, reduced the LD_{50} value for *91-R* by 10-fold. Differential expression of ABC transporter genes by quantitative real-time PCR revealed significant 36%, 39% and 35% overexpression of *mdr50*, *mdr65* and *dMRP* in *91-R* compared to *Canton-S*, respectively. Double stranded RNA was injected into live females to knockdown the constitutive overexpression of these genes in *91-R* and quantified with qPCR. Mortality bioassays have been performed on RNAi-injected females using DDT to determine the reduction in resistance.

AGRO 183
Community-assisted approach to managing host-pathogen interactions of mosquitoes and amphibians in nitrogen-enriched agricultural landscapes

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Landscape alterations and disease emergence are environmental concerns that intersect at aquatic ecosystems. Eutrophication of aquatic ecosystems is attributable to fluctuating nitrogen (N) cycle processes linked to anthropogenic alterations of agricultural landscapes, and is implicated in disease vector emergence. Our study examines the broad-scale patterns of N metabolism over grassland agricultural landscapes to quantify anthropogenic alterations on N cycle processes and subsequent influences on infectious disease ecology. We maintain that grassland agricultural landscapes, properly managed, will increase N retention in soils and minimize reactive N export to agricultural streams that will, in turn, enhance riparian habitat and stream geomorphology to mitigate disease-vectoring mosquito parasite and pathogen infection to amphibian communities. Our research activities are providing educational opportunities that incorporate local and regional communities in an interactive and inquiry-based learning environment that provides a new sense of environmental stewardship among new generation farmers, landowners, and their peers.

AGRO 184
Effects of carvacrol and nootkatone on [^{14}C]-nicotine binding to the house fly nicotinic acetylcholine receptor

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Recent studies with a collection of terpenoids from the heartwood of the Alaska yellow cedar (*Chamaecypars nootkatensis* D. Don) showed high levels activity against pest arthropods, more specifically with nootkatone and carvacrol, but the mechanisms of their action as natural pesticides are not known yet. In this research, we will address the potential for carvacrol and nootkatone binding to the insect nicotinic acetylcholine receptor (nAChR). [^{14}C]-nicotine binding assay to house fly's nAChR was used in this study to test if carvacrol and nootkatone can bind to nAChR and act as agonists for the receptor. In these two terpenoids, carvacrol showed an inhibitory effect on [^{14}C]-nicotine binding to house fly's nAChR, with IC_{50}= 6 µM. The inhibition of binding indicated that carvacrol can bind to house fly's nAChR at the same site as nicotine. Carvacrol may act as an agonist for house fly's nAChR. Nootkatone showed no effects on [^{14}C]-nicotine binding to the house fly's nAChR. We need further evidence to show the mode of action for nootkatone as a natural insecticide.

AGRO 185
Adducts from reactions of aryloxyacetic/propanoic acid herbicides with DNA in plants

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Previous studies indicate that pesticides used in crop production pose risks to agricultural plants, including stress to the plant from lipid peroxidation and alterations of the genome. Methods developed in our laboratories have been used to study 2,4-dichlorophenoxyacetic acid (2,4D), 4-chloro-2-methylphenoxyacetic acid (MCPA), diclofop, and related aryloxycarboxylic acid herbicides and their interactions with DNA in a variety of crop plants, including wheat, barley, soybeans, bush beans, and corn. DNA extracted from treated plants has been subjected to ^{32}P postlabeling studies, yielding evidence of adduct formation with nucleotide bases from pesticides or their metabolites, as well as from products of peroxidation. Direct in vitro reactions of several herbicides with guanosine gave adducts which have been identified by HPLC chromatography. Structure determination has been pursued by electrospray LC-MS and MS/MS spectroscopy. Computational modeling at the B3LYP-6-31G* level is used to relate energetics of adduct formation with experimental herbicide reactivity.

AGRO 186
Development of a high throughput assay to screen natural insecticides: A green chemistry approach to targeting an α-adrenergic-like octopamine receptor from the American cockroach

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The use of conventional synthetic insecticides/pesticides has decreased due to environmental and mammalian health concerns along with resistance to insecticides by target insects. This has led to an investigation of alternative control measures to combat both economically and medically important arthropods. Octopamine, a biogenic amine, has significant physiological functions in invertebrates, including insects, and signals through G-protein-coupled receptors (GPCRs). Insecticidal efficacy at the insects' octopamine receptor is an ideal target because the receptor is not found in mammals at a significant level. Co-evolution of plants with insects has led to plants adapting defensive mechanisms to deter herbivore, microbial, or viral attack. This is sometimes accomplished via the production of essential oils that are composed of a variety of compounds, in particular various forms of terpenoids. The presented research will focus on the development of a high-throughput screening system. Specifically, expression of the *Periplaneta americana* α-adrenergic-like octopamine receptor in the yeast, *Saccharomyces cerevisiae*. This system allows us to pharmacologically analyze this receptor. It is the hope that this system will help in the identification of new and effective insecticidal terpenoids from plant essential oils.

AGRO 187
Environmental fate of erythromycin in aquatic microcosms

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The widespread usage of antibiotics in humans and livestock and their detection in environmental matrices, such as water and soil, has led to an interest in the fate and effects of these compounds and their transformation products. The veterinary antibiotic, erythromycin, is commonly utilized for disease prevention and growth promotion in cattle, swine, and poultry. In this study, erythromycin's fate (degradation, mobility, and transformation) in water and sediment were assessed employing radiolabeled erythromycin in an autoclaved water and sediment system, pond water only system, pond water and sediment containing system, and pond water and sediment system plus a manure amendment treatments. Microcosms were incubated 7, 14, 28, and 63 days utilizing a 12:12 light: dark cycle at 24°C. At each endpoint, microcosms were sacrificed allowing ^{14}C-erythromycin quantification in water and sediment components. Dissolved carbon dioxide and carbon dioxide evolution were additionally examined. Confirmation of erythromycin and its metabolites in microcosm components were analyzed utilizing high-performance liquid chromatography (HPLC) with radio-detection.

AGRO 188
Withdrawn

AGRO 189
Sorption and desorption of ^{14}C-labeled permethrin on concrete

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Insecticides are chemicals specially designed for pest control and intensively used in urban environments. However, little is known about their behaviors on urban hardscapes after deposition. This lack of information hinders the development of integrated insecticide mitigation practices. In this study,

^{14}C-permethrin was used as a model compound to evaluate insecticide sorption and desorption on concrete surfaces. ^{14}C-Permethrin displayed fast sorption from water to concrete, and linear sorption isotherm was observed for the aqueous concentration range investigated, with equibrium K_d at 1.91±0.07 ml/cm^2. When equilibrated with water containing Tenax®, ^{14}C-permethrin exhibited fast desorption from concrete in the first 36 h, and contact time on the concrete prior to desorption exhibited a significant impact on ^{14}C-permethrin desorption kinetics. However, after 300 h continuous mixing with water and Tenax®, 19.9±2.6% of the initially applied ^{14}C was still left on non-aged concrete samples, suggesting the potential of extended runoff contamination by permethrin.

AGRO 190
Microbial degradation of etofenprox in a flooded California rice soil

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The microbial degradation of etofenprox, an ether pyrethroid, was characterized under flooded (anaerobic) California rice field soil conditions by determination of its half-life at 25ºC, its dissipation rate constant and identification and quantification of degradation products using LC/MS/MS. The overall 1st order dissipation rate was k=-0.0069, $t_{1/2}$=100 days, r^2=0.5081, which included a quick initial degradation (1st order, k= -0.1967 day^{-1}, $t_{1/2}$ = 3.5 days, r^2=0.6873) followed by a slower secondary dissipation rate (1st order, k=-0.0045 day^{-1}, $t_{1/2}$=154 days). Two main metabolites were identified: 4'-OH (maximum yield 1.34%±0.65 of total etofenprox applied) and -CO (max yield produced 0.93%±0.38 total etofenprox applied). Sterilized soils showed little etofenprox degradation over the 126-d incubation period. Thus, the microbial population in a flooded soil was able to transform and contribute to the overall dissipation of etofenprox.

AGRO 191
Effect of organic waste soil amendments on fate of MCPA in agricultural soils

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Agricultural organic wastes can be disposed of as soil amendments, which also increase the OC content of the soils. In Spain, >4,000,000 tons/yr of olive mill waste is generated. We determined the effect of olive mill waste amendments on the behaviour of the acidic herbicide MCPA in four soils. Soils were amended (10% w/w) with either fresh or composted olive waste from two sites in Spain. Greater sorption and persistence of MCPA was observed in soils amended with the fresh wastes as compared with the unamended soils. However, no differences were observed between unamended and compost-amended soils. Amending soils with fresh and composted wastes reduced MCPA leaching in sandy but not in clay soils. In order to prevent leaching and contamination of groundwater by MCPA through the addition of organic waste, knowledge is needed of the interactions of wastes of different origins and processing on MCPA in soils with different properties.

AGRO 192
PRZM groundwater modeling predictions for a modified acetochlor soil restriction on corn, cotton, and soybeans

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The potential for acetochlor and its two primary soil degradation products acetochlor ethanesulfonic acid (Ac-ESA) and acetochlor oxanilic acid (Ac-OXA) to leach to shallow groundwater was determined following application to corn, cotton, and soybean fields, where acetochlor may be applied under a newly proposed soil restriction, which would allow applications to certain vulnerable soils while observing a potable well set-back of 150 feet. Groundwater concentrations predicted by US EPA's Pesticide Root Zone Model (PRZM) Version 3.12.2 were used to calculate potential high-end groundwater concentrations in hypothetical vulnerable drinking water wells located 50, 100, and 150 feet from the nearest acetochlor treated fields. Modeling demonstrated that concentrations of parent acetochlor, Ac-ESA, and Ac-OXA predicted in groundwater can be considerably reduced via well setbacks. Using groundwater velocities of 0.02 and 0.15 m/d, setbacks of 50, 100, and 150 feet reduced maximum off-site concentrations between 76 - 99%, and 18 - 44%, respectively.

AGRO 193
Detection and quantification of atzA in rhizosphere soil and enhanced bioremediation of atrazine by *Pseudomonas sp.* strain ADP

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The contamination of soil and drinking water sources by atrazine (ATR) and its metabolites has raised public health concern. *Pseudomonas sp.* strain ADP is a unique ATR degrader in that it can completely degrade ATR into CO_2 and NH_3. The addition of *Pseudomonas sp.* strain ADP biodegrading bacteria into established riparian vegetative buffer strips (VBS) to degrade the entrapped ATR is a promising approach for the removal of ATR. There are many difficulties in quantification of bacterial genes, especially atzA, a gene encoding chlorohydrolase AtzA, in rhizosphere soil. In this study, four molecular quantitative methods for quantifying the copy number of atzA were successfully developed and compared. We compared three PCRbased methods, quantitative competitive PCR and two real-time PCR methods, to traditional dilution-plate counting techniques. We demonstrate the optimal properties of the Taqman-based real-time PCR assay for studying the persistence of the ATR degraders in the VBS systems.

AGRO 194
Assessment of zero-valent iron and *Bacillus subtilis* for the degradation of butachlor from synthetic water

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Zero-valent iron (ZVI) has great potential to be used as a remediation material for the removal of a wide range of herbicides from contaminated groundwater and soil. In the present study, we have assessed the feasibility of zero-valent iron and biological reactive material (bacteria) for the degradation of butachlor from synthetic water. Several butachlor resistant bacteria were isolated from the rhizosphere soil and the isolate which exhibited a maximum resistance (23 ppm, 4 times) to butachlor was selected for further studies. Four different sets of the batch experiment were conducted with the zero-valent iron and bacteria. Results of the batch experiments indicate that the sequential treatment (chemical treatment followed by biological treatement) has successfully degraded about 95% of butachlor from the synthetic water. The degradation of butachlor was confirmed by measuring the chloride ion (Cl^-) concentration in Ion Chromatography (IC). Based on the 16S rDNA sequences the potential isolate was identified as *Bacillus subtilis*.

AGRO 195
Use of the Riparian Ecosystem Management Model (REMM) to predict novaluron off-field loading trapment by a vegetative filter strip using data from a simulated rainfall vegetative filter strip effectiveness study

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In 2006, a simulated rainfall vegetative filter strip (VFS) effectiveness field study using the broad spectrum insecticide novaluron was conducted on a cotton field in Mississippi. The objective of this field study was to assess the effectiveness of a VFS in reducing the transport of novaluron in off-field runoff and erosion. In this modeling study, observed off-field loadings of runoff, sediment, and pesticide masses were input into the Riparian Ecosystem Management Model (REMM; version 2009) to estimate VFS effectiveness for trapping novaluron residues. The objective of this modeling study was to compare REMM predicted outer edge-of-VFS novaluron mass against the observed results from the VFS effectiveness study using observed soil/meteorological parameters in conjunction with calibrated hydrology. The pesticide module in REMM includes capability to simulate both linear and non-linear adsorption/desorption behavior. Novaluron is a high Koc compound which is more accurately simulated using non-linear adsorption/desorption kinetics. This modeling study demonstrated REMM can be an effective tool for estimating trapment of a high Koc pesticide by a VFS adjacent to an agricultural field.

AGRO 196
Sorption of naphthalene and 1-napthol to turfgrass thatch as influenced by thatch chemical properties

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Organic carbon partition coefficients derived from mineral soils do not accurately predict pesticide sorption to turfgass thatch. We examined the sorption capacity of two pesticide metabolites to 11 thatch samples, and measured the carbon (C), hydrogen (H) and oxygen (O) content of each sample to determine if the atomic ratios of the three elements could be used to predict the sorption capacity of thatch. The sorption of naphthalene and 1-napthol was invariant of the O/C and (O+N)/C content of thatch as well as to organic carbon content of thatch. Sorption was positively correlated to the N/C ratio of thatch with 48% of the variation being explained by the ratio. Our results suggest that the state of organic matter decomposition within thatch, as measured by the N/C ratio, is a better predictor of the pesticide sorption to thatch than is the amount of organic carbon present in thatch.

AGRO 197
Survey of replacement pesticides in Ventura County watersheds

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Ventura County is one of most important agricultural regions in California. Contamination of surface water by pesticides from agricultural runoff is a signficant concern. This study surveyed the occurrence of replacement pesticides in three major watersheds within Ventura County. A total of 15 sites were selected. Paired sediment and water samples were collected and analyzed for a suite of insecticides, herbicides and fungicides. Water samples were further subjected to acute toxicity testing using *Ceriodaphnia dubia*. The most detected pesticides in both sediments and water were chlorpyrifos, bifenthrin and *trans*-permethrin. Diazinon, chlorothalonil and prometryn were often found in water but not in the sediment phase. Presence of pesticides in water was correlated with suspended solid levels, suggesting particle-associated movement of hydrophobic compounds. Significant toxicity was found in about 25% of the samples. Results so far suggest widespread occurrence of pyrethroids in both water column and bed sediments in the watersheds.

AGRO 198
Pyrethroid pesticide analysis in wastewater effluent by NCI GCMS SIM

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This work is based on the Robinson/Syngenta NCI GCMS SIM sediment method applied to secondary treated municipal wastewater effluent. Municipal effluent used as a challenge matrix for demonstration of single digit part per trillion reporting limits. Clean-ups employed to minimize matrix affects

AGRO 199
Herbicide tolerant crops: Utilities and limitations for herbicide resistant weed management

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Since 1996, genetically modified herbicide tolerant (HT) crops, particularly glyphosate tolerant (GT) crops, have transformed the tactics that many growers use to manage weeds. The use of GT crops continues to grow, but weeds are adapting to the common practice of using only glyphosate. Growers using only a single mode of action to manage weeds need to change to a diverse array of herbicidal, mechanical, and cultural practices to maintain herbicide effectiveness. Unfortunately, the introduction of GT crops and the high initial efficacy of glyphosate often lead to a decline in use of other herbicide options and a reduction in herbicide value that result in less investment to discover new products. With one major exception that occurs in some cotton growing areas, most growers can still manage their weed problems with currently available selective and HT crop-enabled herbicides without changing their preferred cropping systems. However, current management systems may be in jeopardy given the speed weed populations are evolving resistance. New HT crop technologies will expand the utility of currently available herbicides and provide interim solutions for growers to manage herbicide resistant (HR) weeds, but will not replace the long-term need to discover herbicides with new modes of action. The paper reviews the strengths and weaknesses of anticipated weed management options and the best management practices that growers need to implement in HT crops to maximize the long-term benefits of current technologies and reduce weed shifts to difficult-to-control and HR weeds.

AGRO 200
Genetic engineering of crops for resistance to treatment with the herbicide dicamba

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Genetically engineered, dicamba resistant soybean and cotton varieties will soon be in the marketplace. This new technology will allow farmers to control broadleaf weeds in these two broadleaf crops in an efficient, economical and environmentally friendly manner. Equally important, the technology will allow farmers to control many of the broadleaf weeds that have developed some degree of tolerance to the widely used herbicide, glyphosate. Likewise, the emergence and spread of glyphosate tolerance in additional broadleaf weed species should be slowed. Thus, the effective “lifetime” of the glyphosate resistance technology should be prolonged and this technology that farmers have rapidly adopted for efficient, flexible and cost-effective weed control (and soil conservation) should continue to benefit agriculture and the environment into the foreseeable future. Dicamba resistant soybean crops treated with dicamba (up to 5.6 kg/ha) in two locations in Nebraska over the past several years have displayed essentially the same agronomic traits as their nontreated progenitor lines.

AGRO 201
Development and performance assessments of DNA and protein-based detection methods for biotech products

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Over the past decade, the application of modern biotechnology to agriculture has resulted in a significant number of commercially successful crops with traits such as insect protection, herbicide tolerance, and more recently agronomic and quality traits. With increasing prevalence of such products in the marketplace as well as the development of global food and feed labeling requirements, there is high demand for accurate and robust detection methods to support global trade and consumer preference. The focus of this presentation is to describe the principles, methodology and specific requirements used by the biotechnology industry and Monsanto Company to develop and validate qualitative and quantitative detection methodology. Current methods are either DNA or protein-based and include PCR and Real-time PCR for technologies for DNA detection and ELISA and LFS technologies for protein detection. The parameters for assessing the performance of these methods typically include linearity, accuracy, repeatability, robustness, and transferability. Each parameter will be discussed in detail with respect to the performance assessment on both single-trait and combined-trait products.

AGRO 202
Improving and preserving high-performance weed control in herbicide tolerant crops: Development of a new family of herbicide tolerant traits

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Dow AgroSciences’ family of Herbicide Tolerant Trait (DHT) Technologies will enable new selective uses of proven, broad-spectrum herbicides. Derived from common soil bacteria, *DHT1,* from *Sphingobium herbicidovorans,* codes for an enzyme that metabolizes phenoxy auxins such as 2,4-dichlorophenoxyacetic acid (2,4-D) as well as aryloxyphenoxypropionate graminicides such as R-quizalofop. *DHT2,* from *Delftia acidovorans,* inactivates certain phenoxy auxins like 2,4-D, as well as certain pyridyloxy auxins. Both traits convey tolerance in multiple crops to soil and postemergence herbicide applications. DHT1-corn, DHT2-soybeans, and DHT2-cotton will be deployed with other key traits, including traits for insect resistance and traits conferring tolerance to other commercially available herbicides. 2,4-D has been a preferred mix partner with glyphosate for many years in non-selective applications to improve overall weed control. Formulation enhancements will improve the utility and stewardship for broader use of these active ingredients. Once deregulated, DHT technology will enable the selective use of 2,4-D with glyphosate, glufosinate, or other naturally selective herbicides, providing growers with cost-effective, efficacious herbicide options with convenient, robust and sustainable weed management systems and the flexibility to farm the way best fitting their operations

AGRO 203
Glufosinate metabolism and mechanism of action in tolerant and non-tolerant plants

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Glufosinate (phosphinothricin) is a wide spectrum non-selective herbicide. It was first isolated from cultures of soil bacteria *Streptomyces viridochromogenes*, and found to be active as an herbicide in 1976. First commercial sales were in 1984 as the ammonium salt of the racemic mix (ammonium-DL-homoalanin-4-yl (methyl)phosphinate). L-glufosinate is a potent inhibitor of glutamine synthetase, a key enzyme in the metabolism of glutamate in plant photorespiration and nitrate assimilation. D-glufosinate shows no herbicidal activity. The subsequent toxic build-up of ammonia in the plant is the herbicidal mode of action. In non-transgenic plants there is little appreciable metabolism from direct application. Metabolism in orchard crops is primarily mediated by soil uptake of non-herbicidal soil degradates. Plants containing the phosphinothricin-N-acetyltransferase (PAT) gene rapidly detoxify glufosinate to the non-phytotoxic metabolite N-acetyl-L-glufosinate. Alternatively glufosinate may be deaminated to 3-methylphosphinico-propionic acid, acetic acid and other minor metabolites. Metabolism in non-transgenic and transgenic plants will be presented.

AGRO 204
Evaluation of compositional equivalence for multi-trait biotechnology crops

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Compositional analysis is an important tool in the evaluation of the safety and nutritional status of biotech crops. As part of a comparative assessment between the biotech and the conventional crop, their 'substantial equivalence' is assessed by measurement of the levels of key nutrients, anti-nutrients and secondary metabolites. Previous studies for two insect-protected traits in corn, MON 810 and MON 863, and a herbicide-tolerance trait in corn, NK603, have demonstrated compositional equivalence between these products and their conventional comparators. To assess the impact of using conventional breeding to combine multiple traits, the composition of the double combinations, MON 863 × MON 810, NK603 × MON 810 and MON 863 × NK603, and the triple combination, MON 863 × MON 810 × NK603, was compared to their respective near isogenic, conventional comparator. In all cases the combined trait product was compositionally equivalent to its comparator indicating the absence of any influence of combining insect protection and herbicide tolerance traits on composition.

AGRO 205
Urban runoff as a source of pyrethroid pesticides and their effects on surface water bodies

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Sampling in many California communities has shown that urban runoff routinely contains pyrethroid insecticides. Moreover, runoff is routinely toxic to a sensitive species, the amphipod Hyalella azteca. Since discharge of urban runoff is accompanied by substantial dilution, water quality in several creeks and rivers was monitored as they passed through urban centers to determine if input of runoff was sufficient to result in surface water toxicity. Creeks passing through Vacaville, California attained pyrethroid concentrations many times lethal thresholds for Hyalella. More surprisingly, a larger river, the American River that passes through Sacramento, received sufficient pyrethroids to exceed toxic thresholds over 30 km of the river. The data provide clear evidence that pyrethroids, often viewed as toxicants in bedded sediments, can also cause toxicity in the overlying water. The frequency of toxicity was a function of river flow, with impacts aggravated at times of low flow in the dam-controlled river.

AGRO 206
Urban pesticide monitoring in northern and southern California: A regional look at urban pesticides in surface waters

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Recently, interest in urban use pesticides has increased due to their presence in urban surface waters and their potential impact on sensitive aquatic species. CDPR has concluded a year long monitoring study in four metropolitan areas of California. Samples collected from urban storm drains and creeks during the dry and rainy seasons were analyzed for various insecticides and herbicides. Fipronil (and degradates), bifenthrin, auxin herbicides, pendimethalin, prodiamine, and diuron were the most frequently detected pesticides. Oryzalin, carbaryl, malathion, diazinon, and chlorpyrifos were less frequently detected. More detections, or higher concentrations, were detected during storm sampling than during dry season sampling. Independent of season, in Southern California the number of detections in storm drains and creeks were similar. This was not the case in Northern California; dependent on area, either storm drains or creeks had more pesticide detections. Of the pesticides detected, only diuron and bifenthrin exceeded available measured toxicity endpoints.

AGRO 207
Pesticide pollution in runoff from northern and southern California neighborhoods

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Water samples were collected every 1-2 weeks beginning in mid-2006 from 8 residential neighborhoods in Sacramento and Orange Counties. The samples were analyzed for the ant control products chlorpyrifos, diazinon, pyrethroids (9), and fipronil. By the end of 2008, between 69 and 95 samples of storm and nonstorm runoff were collected from each site. Detection frequencies of the organophosphates, bifenthrin, and fipronil were very high, nearly 100% at some sites. Concentrations of bifenthrin and fipronil were detected as high as 6,100 and 10,000 ng/L, respectively, and median concentrations were as high as 36.6 and 112 ng/L, respectively. Runoff depth and velocity were recorded continuously. In addition to characterizing the runoff from these sites, this study also integrated information from controlled studies, refined dry and wet season load models, and conducted and evaluated outreach activities.

AGRO 208
Fipronil and metabolites in runoff from residential homes

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Fipronil was registered for urban use in the late 1990s in California. The last decade saw a rapid increase in its annual usage. Fipronil and its major metabolites are known for their acute toxicity to shrimp-type anthropods. In this study, we monitored for the levels of fipronil, fipronil sulfone, fipronil sulfide and desthiofipronil in runoff originated from single-family homes in Sacramento and Orange County. Monitoring over two years showed that fipronil and metabolites were constantly present in residential runoff water at all sampling sites. The overall levels were substantially higher in the runoff from Orange County than from Sacramento County. In urban sediments, fipronil and the three metabolites were relatively persistent with half-lives ranging from several months to over one year. These findings suggest that fipronil use around homes in California is resulting in widespread and likely persistent contamination of urban waterways with fipronil and its metabolites.

AGRO 209
Distribution and toxicity of pesticides and other contaminants in stream sediments in relation to urbanization

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To assess contributions of current and legacy pesticides and other contaminants to sediment toxicity in urban streams, organochlorine compounds, pyrethroid insecticides, polycyclic aromatic hydrocarbons (PAH), and trace elements were evaluated in stream sediment from seven metropolitan areas across the U.S. Organochlorine compounds, bifenthrin, PAHs, and six trace elements were significantly related to urbanization and (except bifenthrin) to sediment organic carbon. Differences in contaminant levels among study areas remained after accounting for effects of urbanization and sediment organic carbon using multiple regression. Potential toxicity, assessed using Probable Effect Concentration-Quotients (PEC-Q) and whole-sediment bioassays with the amphipod *Hyalella azteca*, increased with increasing urbanization. Mean PEC-Qs were dominated by trace elements at undeveloped sites, and organic contaminants (especially bifenthrin) at highly (>50%) urban sites. Amphipod toxicity was significantly related to the mean PEC-Q when bifenthrin was included. This study suggests bifenthrin is important to observed and predicted sediment toxicity in these urban streams.

AGRO 210
Pesticide toxicity in urban creeks of Sacramento, California

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Until recently, the waterflea, *Ceriodaphnia dubia*, was the most commonly used test species to study the effects of insecticides in ambient water samples. This study evaluated the presence of toxicity due to pesticides in Sacramento urban runoff using 96-h bioassays with the amphipod, *Hyalella azteca*. Water samples were collected in February and March 2008 following rain storms. Water column tests were performed concurrently at 15 ºC and 23 ºC to determine temperature effects on toxicity, followed by toxicity identification evaluations on select samples. Our data shows that urban runoff was highly toxic to *H. azteca*, likely due to pyrethroid and other insecticides. We confirmed that *C. dubia*, as test organisms, is not sensitive enough to detect water-column toxicity of current-use pesticides in urban runoff. In addition, we demonstrate that commonly used bioassay endpoints may be inadequate to predict the ecological impacts of insecticides common in urban runoff.

AGRO 211
Potential influence of physical habitat, pyrethroids, and metals on benthic communities in a residential California stream

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This three-year study was designed to charaterize benthic communities and physical habitat annually at 21 sites in a residential stream (Pleasant Grove Creek) in California from 2006 to 2008. Concurrent water quality evaluations, physical sediment parameters, pyrethroids, and bulk metals (including SEM/AVS) were also measured. Univariate and stepwise multiple regression techniques were used to determine the relationships between 14 benthic metrics and habitat metrics, pyrethroids, and metals. Over 100 benthic taxa were reported in this stream during each year and these communities were dominated by tolerant taxa such as oligochaetes, chironomids, and snails. In general, total physical habitat scores were considered poor in this stream for all three years. Results from three years of data showed that habitat metrics (i.e., primarily velocity depth regimes) dominated in their effects on benthic metrics while pyrethroids did not display significant statistical relationships with benthic metrics. The findings from this study indicate that the effects of chemical stressors on benthic communities should: (1) take into account potentially confounding effects of physical habitat conditions and (2) involve an appropriately large number of samples to provide adequate statistical power and a more accurate picture of true relationships, thereby avoiding reporting of potentially misleading conclusions.

AGRO 212
Sediment associated contaminants in urban streams: Pyrethroids and other current-use pesticides

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The occurrence of pyrethroid insecticides in urban streams across the United States has not been well studied despite frequent detections in California urban bed sediments. To characterize the national occurrence of pyrethroids, the United States Geological Survey collected streambed sediment samples in 2007 and 2009. The 2007 study had 99 sample sites from seven major urban areas: Atlanta, Boston, Dallas/Ft. Worth, Denver, Milwaukee, Salt Lake City, and Seattle/Tacoma. Bed sediments were analyzed for 14 pyrethroids and other current-use pesticides such as fipronil. For 2007, bifenthrin was the most frequently detected pyrethroid, 26 total detections, and was detected in every urban area. Four other pyrethroids were detected but much less frequently: cyhalothrin (3), cypermethrin (1), permethrin (1), and resmethrin (1). For all pyrethroids detected, concentrations ranged from 0.2 to 38 ng/g. An

additional study was conducted in 2009 to fill in gaps in urban areas in 26 states.

AGRO 213
Contribution of diet to pesticide exposure in pregnant women and children

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We review three of our studies that considered diet as a source of human pesticide exposure. First, we developed a model predicting exposure to pregnant women living in an agricultural area and compared the model with biomonitoring results. The distribution of organophosphorous pesticide (OP) urinary metabolites in the women were similar to the distribution in US women and could largely be explained by diet, with additional exposure from local pesticide use. Among their children at 6, 12, and 24 months of age, intake of >1 daily servings of produce was associated with 36-104% higher OP urinary metabolites. Finally, 40 children were provided an organic diet for 7 of 15 days and their urinary OP metabolite concentrations were 38% lower when they were eating organic food. While our studies also suggest that agricultural and home pesticide use contributed to exposure, our results confirm that diet is a dominant source of exposure.

AGRO 214
Pesticides and PCBs detected in the milk of women residing in urban and agricultural communities of California

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Human milk, the primary food for infants, may also be a major source of exposure to persistent and non-persistent pesticides and chemcials; however, chemicals in breastmilk are not monitored in the United States. We measured 8 organochlorines, 14 contemporary-use non-persistent pesticides, and 4 PCB congeners in breastmilk samples from one population residing in an urban city (Berkeley, CA n=21) and two populations residing in the Salinas Valley, California, an agricultural area (n=59, CHAMACOS Study and n=13 PES Study). Detection frequencies were >90% for chlorpyrifos, chlorpyrifos-methyl, permethrin, hexachlorobenzene, b-hexachlorocyclohexane, *o,p*'- and *p,p*'-DDT/DDE, dacthal, and PCBs 118, 138, and 153. Chlorpyrifos median concentrations were 25, 28, and 24 pg/g milk and *p,p'*-DDE median concentrations were 3200, 3500, and 12,000 pg/g milk for Berkeley, CHAMACOS, and PES women, respectively. Persistent pollutants, previously banned in the United States, remain detectable. Non-persistent pesticides used in agriculture and/or the home were also detectable in human milk.

AGRO 215
Presence of organophosphorous pesticides and diakylphosphates in house dust from urban and farmworker homes and their association with urinary diakylphosphate metabolite levels

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Dialkylphosphates (DAPs) are non-specific urinary metabolites for many organophosphorous (OP) pesticides registered by the USEPA. Historically, DAPs in urine have been assumed to result from parent OP pesticide exposures. However, recent evidence suggests that urinary DAPs may also reflect exposure to preformed DAPs in food and environmental media. If humans are directly exposed to DAPs and no further metabolism occurs, then attributing urinary DAPs solely to parent OP compounds will lead to overestimation of exposure to parent OPs and exposure misclassification. To evaluate this hypothesis, we collected dust and child urine samples from urban and farmworker homes in California and measured parent OPs and DAP residues in dust and DAPs in urine. Findings indicate that although DAPs and parent OPs are present in dust, this source may not impact urinary DAP levels and that diet may be the dominant source of urinary DAPs in this population.

AGRO 216
Evidence that the DAP biomarker may lead to overestimates of organophosphate pesticide exposure

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Dialkyl phosphates (DAPs) are currently used as a biomarker of aggregate human exposure to organophosphate pesticides (OPs). It is known that OPs degrade on food commodities to DAPs at levels that approach or exceed those of the parent OP. However, little has been reported on the extent of oral DAP absorption, metabolism and excretion. A 3 hour metabolic time course study was performed with 0.5 mM dimethyl phosphate (DMP) and phosmet using human and rat hepatic microsomes under CYP450 and FMO mediated pH conditions. Microsome metabolism samples were analyzed by LC-MS-MS and the extent of metabolism was assessed. Additionally, a male (250 g) Sprague Dawley rat was orally gavaged with a 20 mg/kg DMP solution and a 24 hour urine void volume sample was collected. The urine of a DMP dosed rat had a distinct LC-MS response, concordant with DMP standards, that is not observed in the control.

AGRO 217
PON1 as a predictor of differential susceptibility of children to organophosphate pesticides

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Research suggests that organophosphate (OP) pesticide exposure may be associated with poorer birth outcomes and neurodevelopment. Individuals' susceptibility to adverse effects of OP pesticide exposure may differ according to their genetic expression of enzymes that detoxify these pesticides. Single nucleotide polymorphisms along the paraoxonase (PON1) gene affect the expression of PON1 enzymes responsible for OP metabolism and detoxification. We investigated whether PON1 genotype and/or enzyme activity were directly associated with birth outcomes or neurodevelopment at age 2 years and whether the associations of prenatal OP pesticide exposure with these outcomes was modified by PON1 genotype and/or enzyme activity. Fetal PON1 genotype and enzyme activity were associated with poorer birth outcomes in this population living in a California farmworker community, and certain genotypes were associated with altered neurodevelopment at age 2. Young children may be differentially susceptible to the effects of OP pesticides on birth outcomes and development.

AGRO 218
Preliminary examination of the movement of select insecticides following their application to simulated cracks and crevices in the US EPA Indoor Air Quality (IAQ) Research House

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Residential use insecticide formulations consisting of a gel bait, an aerosol and emulsifiable concentrate containing fipronil, cypermethrin, permethrin and propoxur were applied to simulated cracks and crevices in the IAQ research house, an unoccupied single family, ranch-style house located a residential neighborhood in central North Carolina. Air and surface concentrations were measured in three rooms for five weeks following applications. A single personal air sampler was operated in each room and surface measures using alcohol wetted wipes were collected at twelve locations from two rooms at each sampling interval. Findings relating the active ingredients spatial and temporal distribution within the house, their association with the compounds physio-chemical properties and implications for human exposure will be discussed.

AGRO 219
Mechanisms of pyrethroid selectivity

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Pyrethroids are widely regarded as relatively safe insecticides. What is the source of their selective toxicity? Early studies identified detoxication by monooxygenases and esterases as important factors limiting the intrinsic toxicity of pyrethroids to mammals. More recent studies identify have identified intrinsic differences in sensitivity at the pyrethroid target site on voltage-gated sodium channels as determinants of selectivity between susceptible and resistant insect populations, between insects and mammals, and perhaps between experimental model organisms and humans. This presentation in honor of John Casida will provide a personal reflection on the search for mechanisms of pyrethroid selectivity beginning more than 30 years ago in the Casida laboratory and extending to current efforts to identify and map the pyrethroid receptor.

AGRO 220
Pyrethroid mode(s) of action

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The SAP (June, 2009) concluded that a common mode of action existed for pyrethroids, with two subgroups. Two types of pyrethroid action were first described for clinical signs (Verschoyle & Barnes, 1980) and clinical signs/nerve effects (Gammon, Brown & Casida, 1981). In insects, Type I clinical signs correlate with repetitive firing in nerve axons, especially fine sensory axons. The sodium inward current is via TTX-sensitive channels (VSSC). Type II (α-CN) effects on VSSCs do not include repetitive firing following stimulation in these axons. Furthermore, Type II effects on VSSCs include prolonged tail currents along with persistent depolarization of nerve membrane. Other Type II effects have been measured on VS calcium and potassium channels and VS and GABA-activated chloride channels. In conclusion, in vivo pyrethroid effects in mammals should be linked with specific channel effects. This would permit using specific clinical signs or ion channel effects for pyrethroid risk assessment.

AGRO 221
Second generation pyrethroids and the cream of the crop, deltamethrin

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Bioresmethrin 5-benzyl-3-furylmethyl 1*R*-*trans*-chrysanthemate, an ester, is an established insecticide. The introduction of novel sustituents at the 3- position of the cyclopropane ring led to the discovery of more potent compounds. Replacement of the alcohol portion of these esters yielded compounds that would prove to be photo-stable. Combinations of both acid and alcohol components gave second generation pyrethroids, with fortuitous properties. Preliminary metabolic studies in rats of the 1*R* isomer of permethrin.

AGRO 222
Pyrethroids: Mammalian metabolism and toxicity

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Synthetic pyrethroids, one of major insecticides groups, are used worldwide to control agricultural and household pests. Mammalian metabolism of pyrethroids was led in 1970s and 1980s mainly by research groups of Professor Casida and Sumitomo Chemical, and the research groups made a great contribution to elucidation of mammalian metabolism of pyrethroids. They showed that ester hydrolysis and oxidation play a predominant role on mammalian metabolism of pyrethroids and that rapid metabolism leads to low mammalian toxicity. These metabolic reactions are mediated by carboxylesterases and CYP isoforms. In addition, metabolites formed by oxidation and ester hydrolysis undergo various conjugation reactions. In general, there is substantially no significant species difference in metabolic reactions of pyrethoids and their optical isomers showed no

remarkable difference in metabolism except for fenvalerate. Mammalian metabolism of about 20 pyrethroids will be discussed with focus on metabolic reactions.

AGRO 223
Ryanodine receptors: From discovery to molecular and cellular targets for non-coplanar PCBs and related compounds of concern to environmental health

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Ryanodine receptor (RyR) isoforms have been shown to contribute important signaling functions in both excitable and non-excitable tissues. RyRs are highly regulated microsomal Ca^{2+} channels that have been implicated in a broad array of physiological and pathophysiological processes. This presentation summarizes results from several studies that have defined the structure-activity relationship (SAR) for polychlorinated biphenyls (PCB) toward enhancing RyR activity, and describes the underlying molecular mechanisms that stabilize the full conductance open state of the channel. In vitro and in vivo studies have revealed that RyR active PCB congeners alter neuronal and muscle development. Results from SAR studies with brominated diphenylethers (BDEs) indicate that ortho-substituted BDEs lacking *para*-Br are most active towards RyRs and the antibacterial triclosan also possess potent activity towards dysregulating Ca^{2+} signaling mediated by RyRs. Considering the role of RyR isoforms in heritable human disorders, the basic and clinical implications of RyR-mediated mechanisms in toxicity will be discussed.

AGRO 224
Award Address (ACS Award for Team Innovation Sponsored by the ACS Corporation Associates). Anthranilic diamide insecticides: Selective activators of insect ryanodine receptors

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The ryanodine receptor (RyR) is an intracellular calcium channel that plays a critical role in muscle contraction. For decades the RyR has been recognized as a potential target for insect control. During the 1980s and 1990s, pioneering research conducted in the Casida lab laid the groundwork for characterizing the biochemical interaction between ryanoids and RyRs. Interestingly, synthetic molecules that target RyRs and possess commercial utility have only recently been discovered. Such insecticides include the phthalic diamide, flubendiamide, and the anthranilic diamide, chlorantraniliprole (Rynaxypyr®). Anthranilic diamides are highly potent and selective activators of insect RyRs. Biochemical studies reveal that these insecticides bind to a site on the receptor distinct from that of ryanodine. Cyantraniliprole (CyazypyrÔ), currently in development at DuPont, exhibits broader insecticidal spectrum than Rynaxypyr®. Comparative calcium studies conducted using recombinant insect RyRs show that CyazypyrÔ's improved hemipteran efficacy is related to physical properties rather than intrinsic receptor potency.

AGRO 225
Phytomonitoring and phytoremediation of agrochemicals and related compounds based on recombinant P450s and AhRs

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Molecular mechanisms of metabolism and modes of actions of agrochemicals are significant bases for understanding selective toxicity and resistance as well as monitoring exposure and biological effects on non-target organisms. During 1969 to 1971, I had research training as a postdoctoral scientist in this area in the laboratory of Professor John E. Casida. The major work was "Glutathione s-transferases liberate hydrogen cyanide from organic thiocyanates". During 1972 to 1981, I worked on research and development of agrochemicals in Takarazuka Research Center, Sumitomo Chemical Co., Ltd. The major works were "Stereoselectivity of organophosphorus insecticides", and "metabolism, bioaccumulation and biodegradation of the insecticide fenvalerate". During 1981 to 1991, biotechnology research was started up in Takarazuka Research Center. I worked mainly on gene engineering of cytochrome P450 monooxygenases for bioconversion of fine chemicals including agrochemicals. During 1991 to 2001, both agrochemical biochemistry and gene engineering were combined in Kobe University. Basic technologies on phytoremediation, phytomonitoring and biochemical assays of agrochemicals and related compounds by the use of recombinant P450s, AhRs and antibodies were almost established. During 2001 to the present, research center for green science was started in Fukuyama University, in which how to practically use biochemical assays based on molecular mechanisms of modes of actions of agrochemicals and related compounds by the use of recombinant AhRs and antibodies specific to agrochemicals are major research targets.

AGRO 226
Role and impact of Bt transgenic cotton on integrated pest management

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Transgenic cottons producing Cry toxins from *Bacillus thuringiensis* (*Bt*) control lepidopteran pests and were first commercially grown in Australia, Mexico and the USA in 1996. As of 2008, seven additional countries (Argentina, Brazil, China, Colombia, India, South Africa, Burkina Faso) grow *Bt* cotton on a total production area of over 14.5 million hectares. The technology primarily provides highly selective and effective control of bollworms, the most damaging pests of cotton worldwide. Between 1996 and 2006 the deployment of *Bt* cotton reduced the volume of insecticide active ingredient used for pest control by 128.4 million kg (24.6% reduction in EIQ) and increased farm income through reduced costs and improved yields by US$9.6 billion, with most of the benefit accrued by farmers in developing nations. Reductions in insecticide use have broadened opportunities for biological control and recent meta-analysis has demonstrated that Bt cotton has little or no non-target effects. Most other pest management tactics in *Bt* cotton have remained largely unchanged although several non-target plant bug pests have become more problematic in *Bt* cotton fields in some countries largely due to reductions in insecticide use for target pests.

AGRO 227
Trends in concentrations and use of agricultural herbicides for Corn Belt rivers, 1996-2006

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Trends in the concentrations and agricultural use of atrazine, acetochlor, metolachlor, and alachlor were evaluated for major rivers of the Corn Belt for 1996–2002 and 2000–2006. Trends were analyzed for 11 sites on the mainstems and selected tributaries in the Ohio, Upper Mississippi, and Missouri River Basins. Concentration trends were determined using a parametric regression model that incorporates seasonal variability, flow-related variability, and trends in pesticide concentrations. Most of the trends in atrazine and acetochlor concentrations were small and nonsignificant, but metolachlor and alachlor were dominated by varying magnitudes of concentration downtrends. Overall, trends in herbicide concentrations were consistent with trends in agricultural use—84 of 88 comparisons for different sites, herbicides, and time periods showed no significant difference between concentration trends and agricultural use trends. Results indicate that decreasing use appears to have been the primary cause for the concentration downtrends during 1996-2006.

AGRO 228
U.S. EPA regulation of plant-incorporated protectants: Assessment of impacts of gene glow from pest resistant plants

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The U.S. Environmental Protection Agency regulates pesticide-expressing plants (PIPs) under authority of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). When these PIPs are intended to be used as food or feed sources, the EPA also sets tolerances under the Federal Food, Drug and Cosmetic Act (FFDCA). Once a tolerance or exemption from the requirement of a tolerance has been approved under FFDCA and a FIFRA registration issued, outcrossing between PIP plants and sexually compatible crops does not represent a regulatory violation. However, when sexually compatible wild relatives (SCWR) are sympatric with PIP crops, there is a need to assess the potential for adverse effects to man and the environment. Genetic compatibility, introgression, weediness of SCWR x PIP hybrids, seed dispersal and dormancy, among other parameters, need to be considered as part of the risk assessment. EPA is currently developing data requirements and guidance toward addressing gene flow from PIPs.

AGRO 229
Approaches to tier-based non-target organism testing of RNAi pest control traits

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RNAi technologies are a suggested approach for use as the next generation of Plant Incorporated Protectants to provide crop protection against some insect pests. Before commercialization and use in the field an Environmental Risk Assessment (ERA) of these traits will be conducted including a determination of the need for an assessment of potential effects on non-target arthropods (NTO). The Tier-based approach developed for pesticides and modified for evaluation of insecticidal proteins currently used in genetically modified (GM) crops can serve as a model for the evaluation of RNAi plant protectants. We discuss the use of the Tiered Approach to evaluate the NTO safety of RNAi technologies.

AGRO 230
Relevance of traditional IPM strategies for commercial corn producers in a transgenic agroecosystem: A bygone era?

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Just slightly over 50 years ago, a landmark paper was published by the California Agricultural Experiment Station (Hilgardia, Volume 29, Number 2, pages 81-99) titled *The Integrated Control Concept*. The authors of this paradigm-shifting journal article were entomologists with the University of California system: Vernon M. Stern, Ray F. Smith, Robert van den Bosch, and Kenneth S. Hagen. These entomologists began to describe concepts that are just as important and relevant today as they were 50 years ago, including: economic injury level, economic threshold, general equilibrium position, integrated control, natural control, biological control, and selective insecticides. The authors of this seminal paper hoped that by applying these ecological-based concepts in the management of insect pests, future problems could be largely avoided. A half-century has elapsed since Stern and his colleagues published their paper. Maybe now is a good time to pause and assess how well the integrated control concept is being applied in the commercial production of corn within the United States. One primary concern is the lack of integration of other insect management tools and the overreliance on the transgenic approach even when sub-economic densities of insect pests is the norm for many fields.

AGRO 231
Resistance evolution in insects: Bt crops vs. insecticides

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The evolution of resistance for both Bt crops and insecticides is driven by the same factors: the frequency of resistance alleles, extent of refuges, and especially toxin concentration or dose (which determines the relative fitness of susceptible insects and heterozygotes). However, the impact of concentration is generally very different between Bt crops and insecticides. Resistance to insecticides tends to be effectively dominant due to residue decay in the field, the range of life stages exposed, and resistance mechanisms. Fortunately, resistance to Bt is usually recessive, the plants target very sensitive life stages, and there is less residue decay. Resistance management strategies for Bt crops have also been more successful in assuring that refuges are preserved. Thus, whereas toxin mixtures and relatively high toxin expression combined with refuges can delay resistance significantly for Bt crops, they are generally much less effective than pesticide rotations for delaying resistance to insecticides.

AGRO 232
Differences between ecological risk assessments for transgenic crops and chemical pesticides: The role of the environment in mitigating adverse effects

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Ecological risk assessments for regulatory approvals of chemical pesticides can be relatively straightforward: low risk from a chemical can be concluded from studies of its effects on indicator organisms in the laboratory and conservative predictions of exposure in the field after its use. Ecological risk assessments of transgenic crops, on the other hand, have tended to require field data before low risk can be concluded, even when the active ingredients have no observable adverse effects in laboratory tests at concentrations greatly in excess of those in the crop. A common justification for field studies of transgenic crops is that environmental interactions may intensify any adverse effects the crops may have. In pesticide risk assessment, and in ecological research, it is generally assumed that environmental interactions mitigate effects detected in the laboratory. The origin and implications of these different views are discussed.

AGRO 233
Conventional vs. transgenic insect-resistant plants: Relative impacts on non-target organisms

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In 2008, insect-resistant genetically modified (IRGM) crops were grown on 46 million hectares in 23 countries. Although cotton and maize are presently the only IRGM crops commercially grown, others will follow. The major biological concerns about transgenic insect-resistant are the potential for insects to evolve resistance to the proteins expressed in the plants and the potential effects these proteins might have on non-target organisms (NTOs). Particular concern is whether IRGM crops would have a negative effect on beneficial arthropods such as predators and parasitoids that help regulate pest populations. The presently available IRGM plants express insecticidal crystal proteins (Cry proteins) from the bacterium, *Bacillus thuringiensis* (Bt). Several meta-analysis have been published that collectively show that such Cry proteins do not harm predators or parasitoids in the laboratory or field. Furthermore, when compared to more conventional insecticides, Cry proteins have proven to be far safer to these important arthropods.

AGRO 234
Considerations for environmental risk assessment assay development: Differences between conventional pesticides and biotech crops

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Approaches used in the environmental risk assessment (ERA) of conventional pesticides have evolved over several decades. Approaches for ERAs and regulatory expectations for biotechnology-based solutions have had to develop much more rapidly. In both cases, risk is a function of hazard and exposure and data are generated to test risk hypotheses related to environmental fate/exposure, as well as hazard/effects testing. The analytical challenges to assess the environmental fate of protein-based pest control (e.g. biotech crops) have brought a new set of challenges on top of those common for conventional pesticides. It has been difficult to adapt bioassays established for assessing potential toxicity for conventional pesticides to non-target organisms to exposure scenarios relevant for biotech crops. Lessons learned in environmental risk assessment of conventional pesticides can be useful for biotech crops, however significant technical and regulatory challenges remain.

AGRO 235
What does the agroecosystem look like? Stacks, pyramids and chemicals

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Biotechnology has dramatically impacted agriculture. Growers from a generation ago if they walked though fields of today's genetically-engineered (GE) crops would observe many differences. Now there are fewer weeds due to herbicide-tolerance traits and much less insect damage due to insect-resistance traits. On closer inspection they might even note, especially in corn, the quality of the grain has improved. Adoption of transgenic crops has reduced the use of broad-spectrum chemical insecticides and promoted the use of more environmentally friendly herbicides. However, despite the ongoing advances and exciting potential of agricultural biotechnology, there are many challenges that must be addressed. Already there are multiple GE traits that are being stacked, pyramided or both, and the accompanying chemical applications designed for these traits vary. These combinations of traits and new ones on the horizon may further improve the agronomics of these crops but potentially could be confusing to growers. One challenge that must be addressed is how multiple novel traits and new crop technologies can most effectively be delivered to growers. Another challenge is how can GE crops be integrated into an agroecosystem that truly is more sustainable. In this context, this talk describes the current agroecosystem related to modern weed and pest control, compares it with systems used in the past, and considers how it may compare with future agroecosystems.

AGRO 236
Approaches to assessing the risk to aquatic organisms from pyrethroids in the urban landscapes of California

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A variety of risk assessment tools and paradigms may be used to assess the impact of stressors to the environment. The approach taken is often dependent on the applicable regulatory framework, the primary stressor of interest and the available information. Pyrethroids are under increasing focus in the California urban landscapes due to their widespread use and their detection in aquatic sediment monitoring programs. While a large amount of technical information (with more research ongoing) is available for pyrethroids, new approaches are needed to incorporate the available information into a relevant aquatic risk assessment for the urban environment. Aquatic systems in the urban landscape are strongly influenced by anthropogenic activities through changes in hydrology, physical structure, and nutrient and chemical inputs. This presentation examines how existing risk assessment tools and frameworks can be adapted to assess the risk of pyrethroids to aquatic organisms in urban creeks taking into account the available

information on pyrethroids and the characteristics of the ecosystems of interest.

AGRO 237
Potential impacts of pyrethroid pesticides on the marine environment

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Pyrethroid pesticides are commonly used for structural pest control in urban environments, and are the primary ingredients in the most commonly purchased residential insecticide products. Pyrethroids have been detected at toxic concentrations in sediments from numerous urban creeks throughout California. In a recent state-wide study, total sediment pyrethroid concentrations in creeks proximate to marine receiving waters averaged approximately 50 ng/g (or approximately 5 total toxic units based on *Hyalella azteca* LC_{50}'s). Other recent studies in southern California have detected pyrethroids in harbor and estuary sediments, and toxicity identification evaluations have suggested pyrethroids are contributing to marine amphipod toxicity. Given their wide distribution in coastal urban creeks, and evidence of sediment toxicity in southern California harbors and estuaries, recent data suggest that monitoring should emphasize the potential for pyrethroid impacts in marine systems.

AGRO 238
Effect of sediment organic content and quality on the toxicity of the pyrethroid insecticide cypermethrin

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Assessment of sediment toxicity and ecological risk of pyrethroid insecticides requires better understanding of their behavior in sediment-pore water systems. In particular, information is needed on how organic matter in sediment and water affects the bioavailability and toxicity of pyrethroids to sediment-dwelling organisms. We measured the acute toxicity of the pyrethroid cypermethrin to the freshwater amphipod *Hyalella azteca* in five sediments with varying organic carbon (OC) content. The sediments included three natural sediments with low, medium, and high OC content from California streams, natural sediment from a Massachusetts pond, and an artificial sediment formulated according to OECD guidelines using sphagnum moss as the organic component. The formulated sediment results in OC-normalized 10-d LC_{50} values approximately 3 to 4 times lower than the LC_{50} values measured in natural sediments, suggesting that the sphagnum moss in the formulated sediment has a lower binding capacity for cypermethrin than naturally weathered organic material in field-collected sediments. Concentrations of cypermethrin in pore water measured using liquid-liquid extraction were 11 to 280 times greater than those calculated based on the organic carbon partition coefficient (K_{oc}), a result attributable to cypermethrin residues associated with dissolved organic matter in the pore water.

AGRO 239
Comparison of targeted sediment sampling methods for pyrethroids in urban/residential sediments of a California stream

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This study was designed to address the following objectives from nine sample sites in a residential stream in California (Pleasant Grove Creek), that have historically low to high pyrethroid concentrations: (1) determine the % of the sample site (75 m) that is depositional and non-depositional area based on stream mapping of all sites; (2) determine variability of pyrethroid concentrations from targeted sampling of three depositional and three best available habitat areas for benthic invertebrates (biological areas) at all sites; and (3) compare pyrethroid concentrations from the two targeted sampling approaches in depositional and biological areas for all sites. Based on sampling of nine sites in this stream, stream bed sediment was primarily non-depositional. These non-depositional areas, where hydrophobic chemicals such as pyrethroids are not expected to accumulate, generally provide preferred habitat for many taxa of benthic invertebrates. In general, variability of total pyrethroids for replicates was higher in depositional areas when compared with targeted biological areas. A comparison of total pyrethroids (mean values) from depositional samples with biological samples showed that total pyrethroids were consistently higher in depositional samples. In California, current sampling methods for collecting sediment for both chemistry and toxicity testing in wadeable streams generally target depositional areas without considering the spatial scale context (representativeness) of these areas for the entire wetted stream bed of the study site. The results from our study in a typical residential stream in California highlight the importance of "representative sampling" as our data clearly show the predominant type of stream bed material is primarily non-depositional.

AGRO 240
Analytical challenges of assessing pyrethroid concentrations in aquatic environments

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The analysis of pyrethroid insecticides in environmental matrices poses unique analytical challenges, particularly for surface waters, sediments, and sediment porewaters. Pyrethroids are highly hydrophobic and adsorptive, and there is a need for sub part-per-trillion detection limits to fully characterize concentrations of multiple pyrethroids. In aqueous samples, freely dissolved vs. adsorbed compound should be distinguished to determine bioavailable concentrations. Sample extraction strategies include liquid-liquid (LLE) or solid-phase extraction (SPE) followed by GC/MS-NCI or GC/MS/MS, which can provide detection limits in the 0.1 -10 ng/L range but which may not distinguish the bioavailable fraction. We have utilized solid-phase microextraction (SPME) to evaluate the bioavailable fraction of pyrethroids in porewater. SPME derived pyrethroid concentrations are better aligned with values predicted by equilibrium partitioning theory than are values generated by LLE. Given the critical role of sensitive and accurate pyrethroid analysis in water quality evaluation, there is a great need for rigorous verification of analytical detection limits, recovery, reproducibility and discrimination of the bioavailable fraction. In published reports, gross laboratory method comparisons would be useful in addition to reporting of study specific method parameters.

AGRO 241
Washoff of formulated pyrethroid insecticides from concrete surfaces

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Controlled rainfall experiments utilizing drop forming rainfall simulators were conducted to study various factors contributing to off-target transport of off-the-shelf formulated pyrethroid insecticides from concrete hard surfaces. Factors evaluated included active ingredient, product formulation, set time, and rainfall intensity. As much as 60% and as little as 0.8% of pyrethroid applied was recovered in surface runoff depending primarily on product formulation and followed by product set time. Resulting wash-off profiles could be categorized based on formulation, namely the nature of bulk constituent employed to increase the aqueous solubility of the sparingly soluble active ingredient. Formulations utilizing surfactants in place of organic solvents to facilitate pyrethroid delivery resulted in unique wash-off profiles with overall higher wash-off efficiency relative to products primarily formulated utilizing organic solvent. These wash-off profiles could be replicated with formulation-free neat pyrethroid in the presence of linear alkyl benzene sulfonate (LAS) surfactant, implicating surfactants as facilitators of off target transport.

AGRO 242
Offsite transport potential of urban-use insecticides from concrete surfaces

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Insecticides are chemicals intensively used in urban environments for structural and landscape pest control. However, in contrast to their increasing urban use, little is known about their fate and runoff potential on urban impervious hardscapes after deposition. This lack of knowledge obviously hampers the development of integrated insecticide mitigation practices. In this study, four pyrethroids and fipronil in commerical solid and/or liquid formulations were applied onto concrete surfaces and single- or multiple-time wash-off events were performed at different time intervals to quantify their offsite transport potential from concrete surfaces. Washable residues of all test insecticides on concrete decreased rapidly in the first 7 d, with first-order DT_{50} at 0.91-9.43 d^{-1}. Liquid formulations displayed a lower wash-off potential than the corresponding solid formulations. However, most of the test insecticides were still detectable in the wash-off from concrete 56 d after application, indicating their prolonged potential to contaminate runoff water.

AGRO 243
Comparison of pyrethroid insecticide wash-off from urban surfaces

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Studies conducted throughout the nation have documented instances of residential and urban use insecticides in urban waterways exceeding known toxicity and regulatory thresholds for the protection of aquatic life. An improved understanding of the sources and mechanisms by which these compounds reach receiving waters may provide insight into possible mitigation strategies. Impacted urban watersheds are dominated by three principal surface types, impervious hard surfaces, turf grass, and bare or sparsely vegetated soil. Through the use of drop forming rainfall simulators, a number of common pyrethroid containing residential end-use products were applied to concrete, turf grass, and bare soil surfaces and subject to simulated rainfall events under variable rainfall intensity and product application set time. Wash-off fraction, mean event concentration, and total mass loss were greatest from concrete surfaces, although appreciable losses were also observed from turf and bare soil.

AGRO 244
Advances in pesticide application technology

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The need for sustainable use of pesticides, which includes reduction of costs of plant protection, minimizing the environmental impact, and ensuring safety for sprayer operator has been the major driving force for innovations in spray application technology. Decision support systems and precision agriculture tools are used to apply pesticides only when necessary, precisely where needed, and at the locally required dose, in order to minimise the pesticide consumption. The precise application is performed based on pest, disease and weed recognition, crop identification and GPS navigation of the sprayer. Environment is protected by mitigation of contamination risk from both non-point and point sources. Technical solutions such as shielded application, adjustable air assistance and low-drift nozzles are implemented to reduce drift and prevent field surroundings from contamination. The new sprayers reduce the operator's fatigue, ensure safe filling and cleaning of the sprayer and minimize contaminated remnants after the treatments.

AGRO 245
Droplet size recommendations for crop protection products

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The relationship of droplet size to efficacy of crop protection products (CPP) is a complex subject critically important to providing effective application instructions on product labels. In the past, droplet size recommendations were made by specifying nozzle parameters, VMD, and/or spray volume. Each of these approaches has serious limitations. Use of a classification system (fine, medium, etc.) to describe efficacious droplet size spectra provides applicators with the information that they need, while maintaining the flexibility to adjust for the other important factors affecting the

application. It also allows for the use of new spray technologies without the need to change the label, and can provide the information necessary to maintain efficacy while minimizing drift potential. A classification system recognizes the range of droplet sizes produced by any hydraulic nozzle, which are critical to canopy penetration complete coverage. Major CPP suppliers are already changing efficacy testing to support the use of a classification system and meet the need for product use directions that result in efficient applications.

AGRO 246
Electronic canopy characterization and real-time variable rate application in precision orchard spraying

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Lidar sensors have been used for electronic canopy characterization since 2002. Fruit orchards, vineyards and citrus groves have been scanned and defoliated to correlate field measurements and lidar data. Several parameters are estimated in post-processing such as canopy volume, height, width, foliar area and density. A further step has been done using this information for real-time variable rate applications. A sprayer prototype has being developed to estimate instantaneous values of canopy volume (already tested) and foliar density (under development) every 20 cm along the row and to spray accordingly. The control unit acquires lidar data and estimates the flow rate to be applied through each of the three different height dependant sections (only one side of the prototype is implemented for variable rate applications). Three high frequency solenoid valves are responsible to deliver the established flow rate to the nozzles to spray it.

AGRO 247
Applying Force CS insecticide using direct injection technology in a closed-handling central insecticide system

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Force® CS is the new soil-applied insecticide from Syngenta designed to deliver consistent performance in an advanced, convenient liquid formulation. A novel package was developed for closed-handling and a direct injection delivery system. As part of the project, Syngenta Crop Protection formed a partnership with John Deere who developed a Central Insecticide System™ for Force CS. This new and innovative Central Insecticide System allows growers to more efficiently apply Force CS during corn planting. The application system is fully integrated with the planter, so growers can apply Force CS to their corn acres, either full field or as part of their corn rootworm refuge management. The Central Insecticide System draws Force CS from its bag-in-a-box packaging via direct injection, mixes it with water, delivers the mixtureto the individual planter row units, and applies it in a T-band over the furrow so there are no recirculation or compatibility issues. The unique Force CS package consists of a bag-in-a-box, with a closed handling connector that allows the bag to be directly and easily connected to the line leading to the direct injection pump, without the operator coming into contact with the chemical. The system design includes a cabinet mounted on board the planter that contains up to eight Force CS boxes. This paper describes the new concept of an application system that was developed specifically for applying a liquid insecticide with operator safety in mind.

AGRO 248
Classification of spray quality and it's effect on drift management and field efficacy

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There has been an increased emphasis by nozzle manufacturers to engineer spray nozzles that will effectively reduce the volume of driftable fines found in spray droplet spectrums. Concern has been expressed that this increased emphasis in drift reduction is compromising field efficacy. A spray droplet standard (S-572.1) is in place that the EPA recommends and regulators can use in complaint driven situations. The standard is a result of work done in agricultural engineering and is modeled after a similar standard for application of crop protection products in Europe. The purpose of this standard is to define droplet spectrum categories for the classification of spray nozzles which will provide the nozzle user with droplet size information primarily to indicate off-site spray drift potential and secondarily for application efficacy. This presentation/paper will discuss the advantages and disadvantages of using a spray droplet classification system to make crop protection application decisions.

AGRO 249
Influence of target surfaces and adjuvants on deposition characteristics of spray droplets

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The efficiency of spray applications is influenced by the evaporation and residual pattern of pesticide droplets on targets. Evaporation time and final coverage areas of various sizes of droplets on various targets after impact at various relative humidity were measured. The spray mixtures used to form droplets included different combinations of water, adjuvants and pesticides. Adding surfactant into spray mixtures greatly increased droplet coverage area on the surfaces while droplet evaporation time was greatly reduced. Increasing RH could increase the droplet evaporation time greatly but did not change the coverage area. The droplet evaporation time and coverage area increased exponentially as the droplet size increased. Therefore, droplet size, surface characteristics of the target (waxy or non-waxy), RH, and chemical composition of the spray mixture (water alone, pesticide, additives) should be included as important factors that can affect the efficacy and efficiency of pesticide applications.

AGRO 250
Surfactant actions on glyphosate uptake and translocation in velvetleaf plants

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Surfactants play an important role in leaf uptake of glyphosate. Among various types of surfactants, the cationic tallowamine surfactant is commonly used in many glyphosate formulations (e.g. Roundup®). Results showed that tallowamine disrupts leaf cuticle and facilitates glyphosate uptake into the leaf. In contrast, Silwet L-77® is a non-ionic organosilicone surfactant characterized by extremely low surface tension that facilitates rapid spreading

and infiltration through minute pores such as stomata. The contrasting actions of these two surfactants generally result in antagonism of glyphosate efficacy when applied as a tank-mixture. Using velvetleaf (*Abutilon theophrasti*) plants as a model, we examined the effect of a sequential application of Silwet L-77 to Roundup. The results showed that following the initial wave of ^{14}C-glyphosate uptake, the sequential application of L-77 remobilized leaf surface glyphosate thereby creating a second wave of uptake and translocation resulting in increased efficacy as well as rainfastness.

AGRO 251
Spray droplet size optimization through the synergistic combination of nozzle type and novel formulation additives

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A typical agricultural chemical spray process involves atomizing a liquid stream of diluted pesticide solution through hydraulic spray nozzles that inherently produce a wide spectrum of spray droplet sizes. Finer droplets have higher potential of off-target movement or drift, which is of concern due to their potential impacts on neighboring crops and livestock, sensitive ecological resources and human health. Past research in the field has demonstrated that, although spray nozzle selection and application parameters are the key factors in producing the desired droplet size spectrum, the physical properties of the spray solution can have a significant impact on spray droplet size as well. We have been working to understand the impact of a variety of spray solution components on spray droplet size with different nozzle types. We will present data showing the impact of these interactions on measured spray droplet size distribution, as well as wind tunnel drift data corroborating the particle distribution findings. We find that the optimum and most predictable results are best achieved by considering nozzle technology in combination with selected formulation spray additives.

AGRO 252
Deciphering ligand-receptor interactions on nicotinic acetylcholine receptors using engineered affinity labeling reactions

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To investigate ligand-receptor interactions on acetylcholine receptors (AChRs) we developed an engineered site-directed labeling method which uses cysteine-substituted AChRs expressed in cellular systems together with cysteine-reactive ligand analogs to generate a covalent labeling within the target binding site. Proximal apposition of the cysteine thiol function and the reactive moiety of the ligand analog will lead to a covalent bond formation. Demonstration of such a reaction, i.e. by electrophysiology, does allow an accurate positioning of a ligand within the binding site. We synthesized a series of thiol-reactive epibatidine and quinuclidine derivatives as potential ligands for the ACh binding site of α4β2 and α7 AChR subtypes, respectively. Using the acetylcholine binding protein as a structural template of neuronal AChRs and subsequent docking of the synthesized probes, allowed us to select relevant positions for cysteine scanning. Extension of this methodology to the interaction of neonicotinoids with insect AChRs will be presented.

AGRO 253
Unique neonicotinoid binding conformations conferring selective receptor interactions

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Neonicotinoid agonists selectively act on the insect nicotinic acetylcholine receptor (nAChR). The molecular basis for this selectivity is defined by comparisons of two acetylcholine binding proteins (AChBPs) with distinct pharmacological profiles that serve as structural surrogates for the nAChR subtypes. *Aplysia* AChBP has high neonicotinoid sensitivity whereas *Lymnaea* AChBP has low neonicotinoid sensitivity, pharmacologies reminiscent of insect and vertebrate nAChR subtypes, respectively. The ligand-receptor interactions for these AChBPs were established by chemical and structural biology approaches. Neonicotinoids and nicotinoids bind in a single conformation with *Aplysia* AChBP, wherein the electronegative nitro or cyano pharmacophore of the neonicotinoid faces in a reversed orientation relative to the cationic nicotinoid functionality. For *Lymnaea* AChBP, the neonicotinoids have two binding conformations, which are completely inverted relative to each other, whereas nicotinoids appear buried in only one conserved conformation. Therefore, the unique binding conformations of nicotinic agonists determine the selective ligand interactions.

AGRO 254
Withdrawn

AGRO 255
Understanding the mechanisms of spinosad resistance in insects

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Spinosad is an insecticide, derived from the bacteria *Saccharopolyspora spinosa*, with efficacy against a wide range of insects. The mechanism of action of spinosad appears to be unique, with a primary target site being the nicotinic acetylcholine receptor (nAChR). The nAChRs belong to the Cys-loop superfamily of ligand-gated ion channels. Neural nAChRs are composed of five subunits. Each subunit possesses a large N-terminal extracellular domain that includes the acetylcholine binding site and four transmembrane domains. The relatively low number of nAChR subunits in insects is compensated for by diversification due to alternative exon use and RNA editing. Spinosad resistance has been selected for and characterized in several insects. Generally, resistance is monofactorial, recessive and cannot be overcome by insecticide synergists. A summary of the work across numerous species, aimed at understanding the mechanism of spinosad resistance, will be presented.

AGRO 256
Effect of $GABA_A$ receptor subunit composition and agonist on noncompetitive antagonist sensitivity and selectivity

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The γ-aminobutyric acid type A (GABAA) receptor b3 homomer is highly sensitive to noncompetitive antagonist binding. b1 homomer retains only about 10% binding

activity of b3 homomer. This study test the potency difference of b1 and b3 homomer using mutagenesis, chimeragenesis, heteromer combined with a1 subunit and agonist GABA as modulator. Chimer 1(CH1) containing extracellular half of the b3 and b1 transmembrane domains retained about 70% binding level of b3 homomer. Chimer 2 (CH2) with extracellular half of the b1 and b3 transmembrane domains had similar binding activity to b1 homomer. GABA stimulated heteromer a1b1 and a1b3 binding level to 2.0-2.5 folds at 3 mM. Addition of a1 subunit rescued the inactive CH2 close to wildtype a1b1 and 3 mM GABA also increased a1CH2 to high binding activity. Therefore, NCA binding site is tightly regulated by the open-state conformation occupied by receptor that largely decides the sensitivity of GABAA receptor.

AGRO 257
Mode of action of *Bacillus thuringiensis* toxins

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John instilled in us a need to get to details in mode of action investigations. We all heard of the trials and tribulations of neurotoxic esterases (NTE) at Berkeley. Here I will focus on the mode of action of *Bacillus thuringiensis* (Bt) toxins. As with NTE this has been a long journey with many forks in the road. Briefly, both Cry and Cyt toxins from Bt strains act in multistage processes. These involve solubilization and proteolysis followed by binding to specific midgut membrane receptors. This binding is a key determinant for insect specificity of these toxins. Binding is followed by proteolysis, oligomerization and then binding to a secondary receptor that allows for toxin localization to specific cell membrane domains. Such localization leads to pore formation and subsequent cell lysis. Bt also makes a Cyt protein that not only acts as a toxin but also a surrogate receptor for Cry toxins.

AGRO 258
Synthesis of labeled ambroxol and its major metabolites

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Ambroxol is a mucolytic agent used in the treatment of respiratory diseases. Herein, we report the synthesis of carbon-14 labeled ambroxol with the radioactive atom(s) either on the benzylic carbon or uniformly in the cyclohexyl ring with specific activities of 59 and 81 mCi/mmol respectively. We also describe the preparation of deuterium labeled ambroxol, its deuterium labeled tetrahydroquinazoline metabolite (DHTQ), carbon-13 labeled 3,5-dibromoanthranilic acid metabolite (DBAA), as well as an unlabeled *O* -glucuronide conjugate.

AGRO 259
Isolation and inhibitory activities of Okinawan plants metabolites against HIV-1 encoding enzymes

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AIDS is caused by the human immunodeficiency virus (HIV) and remains one of the leading causes of human lives worldwide. The three enzymes encoded by HIV-1 are reverse transcriptase, integrase and protease. Our laboratory has been carrying out isolation of secondary metabolites from different plants in order to assess various bioactivities. Several Okinawan plants like *Alpinia zerumbet*, *Leucaena leucocephala*, *Bidens pilosa*, *Ananus comusus*, etc. are explored for their bioactivity potentialities. The compounds isolated from these plants have shown antioxidant, antimicrobial, anti-inflammatory and several other bioactivities. *A. zerumbet* contains pyrone derivatives, 5,6-dehydrokawain (DK) and dihydro-5,6-dehydrokawain (DDK) along with several other phytochemicals. *L. leucocephala* with a high annual yield and rich palatable protein in foliage could be used as source of animal feed. This plant contains a non-protein amino acid, mimosine, which also have strong bioactivities. The essential oil of *B. pilosa* is found to contain several metabolites with anti-inflammatory activities. *A. comosus*, pineapple, is known for its pharmacologic properties, primarily due to bromelain, and several other low molecular weight compounds. It is proposed that the secondary metabolites present in these Okinawan plants possess activity against HIV-1 encoding enzymes.

AGRO 260
Establishment of analytical method for fenhexamid residue in several representative crops

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Analytical method of fenhexamid in Korean cabbage, mandarin, apple and green pepper were developed with HPLC and LC/MS/MS for official guideline. Crop samples were homogenized, extracted with acetone, and were partitioned with dichloromethane, giving reasonable recovery of >90 %. The extracts were purified with florisil glass column by eluting with a solvent system of 0.1 % acetic acid in hexane-ethyl acetate(17:3). All fenhexamid was recovered in this procedure. Limit of quantification of fenhexamid in various crops was 0.01 mg/kg, and was lower than 1/2 of MRL of fenhexamid in those crops. When recoveries were measured, by employing the established method, at two fortification levels of 10LOQ and 50LOQ, 85.2% to 102.9% of mean recoveries were obtained with coefficients of variation of <10%. The samples were confirmed by LC-MS/MS-ESI(+). The limit of quantitation by LC-MS/MS-ESI(+) was lower than HPLC detection level.

AGRO 261
Identification and characterization of chlorpyrifos-methyl degrading *Chryseobacterium* sp. strain KR200

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The Organophosphorus pesticides are widely used for agricultural and domestic purposes due to their relatively low persistence in the environment. Chlorpyrifos-methyl (CM) is used at a rate of over 14 million pounds per year in US agriculture, ranking it as the second most heavily used pesticide. This study aimed at isolating bacteria from soil and determining their ability to degrade CM and identify the intermediates in culture broth. Bacteria capable of degrading CM was isolated by enrichment culture. *Chryseobacterium* sp. strain KR200 degraded CM up to 91.58% in 7days. Studies with CM in liquid culture of *Chryseobacterium* sp. strain KR200 demonstrated that the isolate hydrolyzed CM to 3,5,6-trichloro-2-pyridinol, and utilized this compound for growth and energy. We performed SDS-PAGE and two-dimensional gel electrophoresis and identified proteins whose expression pattern is affected by CM using mass spectrometry. The results revealed various proteins that can be grouped according to their respective cellular function.

These results highlight the potential of this bacterium to be used in the clean up of contaminated pesticide waste in the environment.

AGRO 262
Improved measurement of sulfur mustard exposure: Hypochlorite oxidation of urinary ß-lyase metabolites to 1,1'-sulfonylbis[2-(methylsulfinyl)ethane], automated 96 well plate SPE and isotope dilution electrospray LC-MS-MS with simultaneous column regeneration

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Sulfur mustard exposure has been demonstrated using various urinary metabolites including the ß-lyase products. In the rat these metabolites include both the mono (MSMEE) and *bis* sulfoxides (SBMSE) and their determination provides unequivocal evidence of exposure, even at low concentrations. An existing ß-lyase metabolite method uses titanium trichloride to reduce SBMSE and MSMEE to the *bis* sulfide, SBMTE, prior to specimen workup and quantitation. While this method is reliable, particularly when using isotope labeled internal standards, it is also time consuming and not suited to high throughput testing. Here we evaluate an alternative approach using initial sodium hypochlorite oxidation of the ß-lyase metabolites. Sodium hypochlorite rapidly oxidizes SBMTE and MSMEE to SBMSE, but further oxidation to sulfones does not occur. The oxidation and subsequent solid phase extraction using a hydroxlyated styrene-divinyl benzene stationary phase are carried out in an automated, 96 well plate sample preparation station. SBMSE ionizes in electrospray LC-MS forming MH^+ ions (m/z 247) – the molecule ions undergo collision induced dissociation with loss of one and two CH_3SOH fragments at increasing energies. Thus, SBMTE is detected and confirmed as $247^+>183^+$ and $247^+>119^+$ transitions. All three ß-lyase metabolites are separated on a polar reversed phase type column allowing study of the oxidation reaction. The potential applicability of the method is demonstrated by determination of calibrators in urine over the concentration range of 0.1 to 50 ng/mL, and by analysis of -lyase metabolites in control and spiked urine pools and spot urine specimens. The calibration curves were linear with correlation coefficients $r^2>0.99$ for both transitions. The SBMSE method has various advantages: oxidation is instantaneous, SBMSE is stable toward autoxidation (unlike SBMTE), and method throughput is several hundred specimens per day using automated specimen preparation and tandem LC operation that simultaneously regenerates one HPLC column while analyzing specimens on a second.

AGRO 263
Toxaphene the mysterious insecticide: Past, present and future

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Toxaphene is a complex mixture of chlorinated bornanes consisting of up to 670 individual congeners. only 40 individual compounds were chemically identified and all of them were found to be chiral. While application of toxaphene was banned in the US in 1980s. Because of its widespread use as an agricultural pesticide, numerous contaminated sites exist throughout the world from tropical climates to the frozen Antarctica. These sites serve as entry points for toxaphene into the aquatic and soil environments, possibly resulting in accumulations in fish and agricultural products. The estimated global use of toxaphene between the years 1950 and 1993 was 13,306,106 kg, US production in year 1974 was 34,200 ton. Toxaphene, is atmospherically transported to non-source regions where it undergo air-water gas exchange and wet and dry deposition onto land and water. The UC Berkeley group under the leadership of Professor John E. Casida had contributed significantly in understanding and breaking the mystery of toxaphene and to establish the knowledge foundation for the of its past and predicting its future. The story of toxaphene will be presented.

AGRO 264
PBPK and probabilistic models for estimating rodenticide exposure and risk to nontarget birds of prey

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Rodents cause significant losses to agricultural commodities and damage to ecological systems. Additionally, rodents vectors diseases which negatively impact humans. Anticoagulant pesticides are effective pesticides for reducing pest rodent populations and associated damage. Unfortunately, non-target wildlife can be negatively impacted by rodenticides via primary exposure (exposure due to consumption of pesticide baits) or secondary exposure (exposure to pesticide due to consumption of poisoned target pest species). In order to mitigate risk to non-target wildlife, the U.S. EPA recently restricted the sale, distribution, use, and packaging of several second-generation anticoagulant rodenticides. This regulatory action will likely be offset by expanded use of other rodenticides, including diphacinone. In order to estimate the risks of non-target rodenticide exposure to birds of prey, we conducted diphacinone toxicity, dosing and residue studies with rats, quail and kestrels. We will use these data to estimate residues in target species, non-target secondary exposure and risk to birds which consume rodents.

AGRO 265
Design and synthesis of isoxazoles and isoxazolines with structural similarities to fipronil

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Fipronil and other phenylpyrazole derivatives, such as ethiprole, act as noncompetitive inhibitors of the GABA-gated chloride channel. Much of the information about the binding site has been determined by the research carried out by John Casida and coworkers. Our goal is to synthesize other heterocycles that could also bind at the fipronil site. We have investigated the synthetic methodology for the preparation of isoxazoles and isoxazolines with similar structural design. These isoxazoles and isoxazolines have been prepared utilizing the 1,3-dipolar cycloaddition between nitrile oxides and alkynes or alkenes, respectively. Oximes are the precursors used to generate the nitrile oxides and synthetic strategies for preparing them will be described. Relative reaction rates of the 1,3-dipolar cycloaddition between nitrile oxides and alkynes and alkenes will also be discussed.

AGRO 266
Are juvenile hormone (JH) analog insecticides metabolized by JH esterase?

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Juvenile hormones (JHs) are sesquiterpenoids that play key roles in insect development. JH analog (JHA) insecticides are "green" compounds that mimic the biological function and often structure of JHs. A JH-selective esterase (JHE) is known to hydrolyze the methyl ester that is found at the end of all JHs. Here, we characterize a recombinant esterase (CqJHE) from the mosquito *Culex quinquefasciatus* in terms of its ability to metabolize JH III and JHA insecticides. CqJHE was highly specific for JH III (k_{cat}/K_m of 1.3 x 10^7 s^{-1} M^{-1}) but could also metabolize JHAs although at a significantly lower rate. Competition assays (10-fold excess JHA relative to JH III) showed that the hydrolysis of JH III by was inhibited the JHAs hydroprene (40%) and kinoprene (50%) but not by methoprene and fenoxycarb. Our current findings indicate that JHAs are metabolized by CqJHE albeit poorly in comparison to JH III.

AGRO 267
Effect of omethoate on the activity of cadinene synthase of cotton seedlings

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Cadinene synthase, which in mevalonate pathway as a sesquiterpene cyclase, is a key branch point enzyme for the synthesis of sesquiterpenoids phytoalexin gossypol in cotton. So, in order to explore the effects of insecticides on plant defense, the effects of omethoate on the activity of cadinene synthase of cotton seedlings were investigated. Taking omethoate-cotton seedling system as object, after germinated for 5days, cotton seedlings with 2 cotyledons were treated hydraulically with 3 concentrations (400, 800 and 1600mg/L) of omethoate, while 800 mg/L omethoate was the recommended dose for practice use. After treated for 12h, 24h, 2d, and 3d respectively, cotton seedlings were harvested. 500 L of react mixture, which included 1mg protein from cotton seedling, and 0.03mM Farnesyl pyrophosphate (FDP) as substrate, was incubated at 30° for 1.5h. After extracted by 1.5 mL of hexane and ethyl acetate (3:1) for three times, the organic layers were used for determining δ-(+)-cadinene by gas chromatography/mass spectrometry (GC/MS). An Agilent Technologies model 6890 GC equipped with a HP-5MS fused-silica capillary column (30m×0.25mm×250μm) was used. An Agilent 5973 mass selective detector was used for total scan of m/z 35 to 550 for characterization, and SIM for quantization of δ-(+)-cadinene. Significance of enzyme activity change was determined with the student's unpaired t-test. Compared with the untreated control, after cotton seedlings were treated for 2 days and 3 days with 3 concentrations of omethoate, the cadinene synthase activities of cotton seedlings increased significantly; also after treated for 24h, 800 and 1600mg/L of omethoate induced the cadinene synthase activities of cotton seedlings significantly, while as after 12h's treating, all of the 3 concentrations of omethoate did not change the cadinene synthase of cotton seedlings significantly. So, omethoate may be an exogenous factor for inducing cotton to activate defense response.

AGRO 268
Metabolism of fenvalerate by human liver microsomes

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This study was carried out to elucidate the formation of metabolite and metabolic pathway of insecticide fenvalerate by human liver microsomes. Pooled human liver microsomes were incubated with 50 μM of fenvalerate in the presence of NADPH-generating system. After the reaction was stopped, reaction mixtures were extracted with 0.5 ml of ethyl acetate and an aliquots (1 μL) were analyzed by GC/MS. Optimized reaction conditions were set with 50 μM of fenvalerate, 0.5 mg/ml of microsomes protein content, and 120 min of incubation time. Six metabolites were identified or characterized including 2-OH-CPIA (4-chloro-(2-hydroxy-1-methylethyl)benzeneacetic acid) isomers. The relative amount of 2-OH-CPIA 1 and 2 were changed by metabolic reaction time. Each CYP isoforms had a different metabolic activity to two isomer of 2-OH-CPIA. Four isozymes (CYP 2B6, 2C8, 2C9, 2C19) mainly contributed to metabolism of fenvalerate. TNRs for 2-OH-CPIA 1 and 2-OH-CPIA 2 were calculated.

AGRO 269
***Anopheles gambiae*-selective, meta-substituted aryl carbamates for control of malaria**

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Acetylcholinesterase (AChE) inhibitors have been widely used to control agricultural pests, and have seen limited use in indoor residual spraying to control vectors of human disease. To date, no AChE inhibitor has been approved by WHOPES for use on insecticide treated nets (ITNs). We have discovered that select aryl methylcarbamates bearing a bulky substituent at C3 can possess excellent selectivity for *Anopheles gambiae* AChE (*Ag*AChE) over human AChE (*h*AChE), and have good contact toxicity vs. *An. gambiae*. Such compounds, deployed on ITNs, could prove useful to reduce malaria transmission. In this presentation we will review the effect of structural variation on *Ag*AChE vs *h*AChE selectivity, and on contact toxicity to *An. gambiae*. Subtle variation in the size and shape of the C3-substituent is found to dramatically affect *Ag*AChE vs *h*AChE selectivity. Enzyme/inhibitor docking studies provide possible explanations for these findings and will be presented.

AGRO 270
Effect of chitosan on the enantioselective ecotoxicity of herbicide dichlorprop in three algae

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The enantioselective ecotoxicity of herbicide dichorprop (DCPP) with chitosan moleculars (CS) and chitosan nanoparticles (NP) in three algae was investigated. CS and NP showed chiral recognition on DCPP in three freshwater green algae, and the chiral recognition is different in different algae. The order is *Chlorella pyrenoidosa>Chlorella vulgaris>Scenedesmus obliquus*. What's more, the same kind of algae shows different responses with CS and NP. The

inbihition of CS on *Chlorella vulgaris* is weaker than NP in the initial 72h and stronger than NP after 96h. For *Scenedesmus obliquus,* CS showed weaker inhibition than NP, but for *Chlorella pyrenoidosa* CS showed stronger inhibition than NP. CS and NP with DCPP can promote the growth of *Chlorella vulgaris* at low concentrations, while inhibite at high concentrations. And the inhibition is different with the order of NP> CS> (*R*)-DCPP-NP > (*R*)-DCPP-CS >> (*R*)-DCPP.

AGRO 271
Enantioselective toxicity of organophosphorus compounds: Malathion, malaoxon and isomalathion

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Stereoselective toxicity of organophosphorus pesticides (OPs) was received increasing attention from ecotoxicological and environmental scientists in recent years. This work investigated enantioselective toxicity of malathion, malaoxon and isomalathion to *Daphnia magna* (*D. magna*) and inhibition of the three compounds to acid - naphthyl acetate esterase (ANAE) extracted from wheat flour, with the purpose of seeking possibility of stereoselective effects of chiral OPs on non-target creature and enzyme. Significant differences were observed between the two enantiomers of malathion and malaoxon and four stereoisomers of isomalathion in LC50 (the concentration caused 50% mortality of the test population) values to *D. magna* and IC50 (the concentration of inhibitor producing half-inhibition of enzyme activity) to ANAE. Enantiomers with *R*-configuration of all the tested compounds showed higher toxicity to *D. magna* than their *S*-forms and racemic forms. Surprisingly, being different from the observation that racemic malaoxon or isomalathion was an intermediate inhibitor to target enzyme, acetyl-cholinesterase (AChE), here racemic malaoxon or isomalathion showed the strongest inhibit strength to ANAE compared to their respective enantiomers and stereoisomers. The observations indicated not only the three chiral OPs had enantioselective and stereoselective toxic effect to non-target creature and enzyme, but also the effect was obviously different from that to target enzyme of OPs.

AGRO 272
Opening a new door of understanding the endocrine disruption: The enantioselective estrogenic activity of SPs

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Enantioselectivity of chiral xenobiotics has become a hot topic in the area of environmental toxicological research. Chiral synthetic pyrethroids (SPs), which has been listed up on the list of (Endocrine Disruption Chemicals) EDCs, are one of the most widely used families of insecticides with a large number of stereoisomers. However, this typical characteristics of chiral has not been recognised in the investigation of endocrine disruption. In this study, we applied yeast two-hybrid and molecular docking (MD) assay to assess the enantioselective estrogenic activities of three common SPs: bifenthrin (*cis*-BF), permethrin (PM) and fenvalerate (Fen). The β-Galactosidase synthesize evaluation indicated that all of the testing SPs displayed significant ($p<0.05$) enantioselectivity. The results manifested that the estrogenic potential of *cis*-BF was mainly attributed to 1*S*-*cis*-BF. Neither rac-PM nor rac-Fen showed estrogenic effects. Nevertheless, two stereoisomers of PM possessed estrogenic potential and 2*R*-*αR*-Fen and 2*S*-*αS*-Fen also can induce the *β*-Galactosidase activity. The inability to initiate the reporter gene in the racemate chemicals may due to the low ratios of these isomers or the antagonism among them. The MD data shows that strong hydrophobic interaction and hydrogen bond between positive estrogenic isomers and estrogen receptor α (ERα), which supports our biological testing results well. Our present research for the first time reported the enantioselective estrogenic activity of chiral SPs causing by selective binding between legends and receptor. The elucidation of the enantioselective estrogenic activity of SPs will open a new door of understanding the oestrogen properties of chiral chemicals.

AGRO 273
Enantioselectivity on zebrafish embryo toxicity of synthetic pyrethroids

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Enantioselectivity in toxicology of chiral pollutants have become one of the frontier topics interfacing chemistry and toxicology. In this study, the enantioselectivity in developmental toxicity of synthetic pyrethroid insecticides (SPs) *λ*-cyhalothrin (*λ*-CT) and *β*-cypermethrin (*β*-CP) was evaluated using the zebrafish embryo-larval assay. The enantiomers of SPs were baseline separated on different chiral columns under optimized conditions. Optical rotatory dispersion (ORD) and circular dichroism (CD) detectors were used to determine the elution order and CD spectra of the enantiomers. Obtained pure enantiomers were used in 4-day zebrafish embryo-larval bioassays, and a series of developmental end points were measured and compared. Significant enantioselectivity was observed in developmental toxicities such as yolk sac edema and pericardial edema. For *λ*-CT, the malformations were induced by the racemate and its (-)-enantiomer at lower concentrations tested (e.g., 0.05 mg L^{-1}), whereas the (+)-enantiomer induced malformations at relatively higher concentrations (≥ 0.1 mg L^{-1}). For *β*-CP, the 1*R*-*cis*-*αS* and 1*R*-*trans*-*αS* enantiomers showed strong developmental toxicities at concentration of 0.1 mg L^{-1}, while the 1*S*-*cis*-*αR* and 1*S*-*trans*-*αR* induced no malformations at higher concentration (e.g., 0.3 mg L^{-1}). The results suggest that enantioselectivity may occur at the developmental level even in the absence of selective acute toxicity and should be considered when evaluating ecotoxicological effects of chiral contaminants.

AGRO 274
Enantioselectivity in environmental safety of chiral pesticides

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Enantioselectivity is important in the field of agrochemicals. Although the enantiomers may behave differently in

biological activities and in biologically mediated environmental processes, the environmental risks of chiral pesticide are mostly understood and regulated as those of achiral ones at present. Studies on environmental enantioselectivity of pesticides firstly appeared in the early 1990s. Most studies focused on the legacy chiral pesticides, such as a-HCH, chlordane, and *o,p'*-DDT. Since 2002, six primary classes of globally used chiral pesticides have been examined. In this article, the environmental enantioselective effects of new (six types) and old (POPs) chiral pesticide are reviewed, such as absorption, aquatic toxicity, cell toxicity, endocrine disruption, carcinogenicity and so on. Enantioselectivity in these aspects is expected to result in ecotoxicity that cannot be predicted from our existing knowledge, and must be considered in future environmental risk assessment and regulatory decisions.

AGRO 275
Enantioselective behavior of metolachlor in maize root in hydroponics

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The enantio-behavior of *rac*- and *S*-metolachlor in maize root was studied in hydroponics. The results showed that *S*-metolachlor was degradated quicker than *rac*-metolachlor. The concentration of *S*-metolachlor is 84.8% of *rac*-metolachlor after 24 h in 18.6 μM treatment, with significant difference ($p<0.05$) between *S*- and *rac*-metolachlor. And the difference existed till the end of the cultivation. The $t_{1/2}$ of *rac*- and *S*-metolachlor is 80.6h and 60.3h in 18.6 μM treatment, respectively. While the root length of maize treated by *S*-metolachlor is 90.7% and 79.5% of rac-metolachlor treatment after 120 h in 18.6 μM and 37.2 μM treatment, respectively. Activities of SOD, POD and CAT of roots were significantly activated by *rac*-metolachlor in 6.2 μM, while the *S*-metolachlor significantly inhibited the SOD, POD and CAT activities. The activities of SOD, POD and CAT of roots treated by rac-metolachlor was, respectively, 1.38-, 1.48- and 4.77-fold that of the *S*-metolachlor. The enantio-behavior of *rac*- and *S*-metolachlor in maize root in hydroponics was observed.

AGRO 276
Enantioselectivity in endocrine disruption and effect on development of breast cancer of *o,p'*-DDT

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Research increasingly suggests that enantioselectivity may exist in acute, chronic toxicological effects and endocrine disruption of chiral contaminants. In this study, we used the human breast carcinoma MCF-7 cell line to evaluate enantioselectivity in endocrine disruption and the effect on the development of breast cancer of *o*,*p*'-DDT. Firstly, significant differences in estrogenic potential were observed between the two enantiomers of *o*,*p*'-DDT in the E-SCREEN assay and qRT-PCR by determination of pS2, ERa and ERb mRNA levels. All the results consistently revealed that the estrogen activity of *R*-(–)-*o*,*p*'-DDT was much higher than that of *S*-(+)-*o*,*p*'-DDT and the enantioselective estrogenicity of *o*,*p*'-DDT was likely through the ERa and ERb signaling pathways. Secondly, we determined intercellular adhesion analysis and mRNA expression levels of MMP-9, MMP-2, TIMP-1, TIMP-2, E-cadherin, *β*-catenin and hTERT which are related to invasion, adhesion and proliferation of breast cancer to preliminarily study the enantioselectivity and mechanism of *o*,*p*'-DDT in breast cancer development. The results show that *o*,*p*'-DDT can promote the invasion ability of MCF-7, which was associated with the up-regulation of MMP-9, MMP-2 gene expressions and the depress of intercellular adhesion. At the same time, the promotion to cell invasion by *R*-(–)-*o*,*p*'-DDT was higher than that by *S*-(+)-*o*,*p*'-DDT. In addition, the frequent cell proliferation is an obvious feature of the development of tumor, while our results show that the racemate and enantiomers of *o*,*p*'-DDT are all able to increase hTERT gene expression, and the effects induced by *R*-(–)-*o*,*p*'-DDT is higher than that by *S*-(+)-*o*,*p*'-DDT. This is one possible mechanism of the effect to breast cancer cell proliferation by *o*,*p*'-DDT enantiomers. Considering, the enantioselective estrogenicity of *o*,*p*'-DDT may be the main reason of the enantioselective effects in breast tumor development.

AGRO 277
Improvement of stereoselective bioassays on pesticide design: An example of methamidophos and its derivatives

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Despite the fact that the biological actions of chiral compounds are stereoselective, this concept has been rarely introduced to solve the designing problems of pesticides. This chapter offered a typical example that the original design chain from methamidophos (Me, *O*,*S*-dimethyl phosphoramidothioate) to chloramidophos (CP, *O*,*S*-dimethyl-N-(2,2,2-trichloro-1-hydroxyethyl)phosphoramidothioate) and then *O*,*S*-dimethyl-N-(2,2,2-trichloro-1-methoxyethyl)phosphoramidothioate (MCP) was successfully improved in virtue of stereoisomeric bioassays. Me is so toxic that it is replaced by CP, a new developed organophosphorus pesticide. However, the subsequent find in the storage instability of the exclusively commercial formulation of CP greatly inhibited its continuous use. After a great deal of effort, it was confirmed that reactions between CP and the cosolvent methanol primarily resulted in the CP's drop in its formulation and meanwhile, a high stable new organophosphate——MCP was fortunately gained. Racemic MCP was determined to be highly active to insects and low acute toxic towards humans. But MCP has potential to induce delayed neuropathy which makes its pesticidal use impossible. Under this background, all of the four stereoisomers (peak 1 to peak 4) of MCP were isolated and prepared on a Chiralpak AD column, and their stereospecific profiles in both target activity and non-target toxicity were measured. A heart-stirring result finally obtained was that pair 1, that is equimolar mixture of peak 1 and peak 3, was about 3.0-fold more active than its racemate but had extremely low potentials to cause acute and delayed neurotoxicities. This product is considered to be worthy to develop as a new pesticide both from its biological predominance and cost effectiveness of view. The above results imply that exploiting space of a new pesticide can be widened when stereoselective biological studies are introduced into the design process.

AGRO 278
Enantioselective toxicity in the zebrafish embryo-larval development of insecticide bifenthrin

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Enantioselectivity is of great importance in assessing the overall environmental risk of chiral contaminants. Bifenthrin

(BF) is a non-cyano pyrethroids with one chiral position and marketed as the racemic form comprised of one enantiomer pair 1*R*-BF and 1*S*-BF. The occurrence of enantioselectivity has been addressed for BF not only in insecticidal activity, but also in environmental behavior and toxicities to nontarget sites. However, so far, limited information is available on the developmental toxicity and locomotor behavior in embryo-larval zebrafish. In this study, enantioselectivity of bifenthrin (BF) in embryo-larval zebrafish toxicity as well as the acute locomotor behavior was evaluated. Significant differences were observed, and results indicated 1*R*-BF were more active in causing morphological impairments, with 96 h-EC_{50} of 226 μg L^{-1} for pericardial edema, and 145 μg L^{-1} for curved body axis, respectively, while no obvious developmental defects occurred for 1*S*-BF even at the highest concentration tested. Administration of two enantiomers of 20 μg L^{-1} BF had differential effects on the locomotor activity of 4dpf zebrafish in alternating light and dark conditions. Larvae treated with 1*R*-BF seemed to be insensitive to the alteration of light to dark and the locomotor activities were reduced to a level similar to that in light which otherwise increased rapidly and markedly. However, treatment with 1*S*-BF did not alter the general pattern of zebrafish response to the light or dark compared to the control. The consistency with insecticidal activity indicated a common mode of action. With regard to effects on the spontaneous movement and the hatching process, different mechanisms seemed to have functioned. 1*R*-BF seemed to have an acceleration effect while 1*S*-BF seemed to be inhibitory. Altogether, results suggested that enantioselectivity may occur in the early life stage of development and should be taken into consideration when evaluating the environmental safety of chiral insecticides.

AGRO 279
Enantioselective effects of organophosphorus pesticide on earthworm biomarkers

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More than 30% of the current used organophosphorus (OPs) insecticides are chiral. The studies of enantioselectivity in the aquatic toxicity of chiral OPs have been steadily increasing, however, research concerning enantioselectivity in the toxicity of OPs to nontarget and non-mammalian species, particularly soil organisms, is still inadequate. In this study, the acetylcholinesterase (AChE) activity and coelomocytes lysosomal membrane stability of earthworm (*Eisenia fetida*) were selected as biomarkers, and the enantioselective effects of three chiral OPs (methamidophos, malaoxon, and isomalathion) were evaluated. The results showed that the enantiomers of OPs could damage the nervous and immune system of the earthworm. The acetylcholinesterase (AChE) activity and neutral red retention time are sufficiently sensitive, quick assessment biomarker for monitoring the pollution of OPs, and could be used as early warning indicators of an adverse impact of pesticides on earthworm populations. The significant differences among the enantiomers were observed, it indicated that the enantiomeric differences should be taken into consideration in assessing of the ecological effects of OPs.

AGRO 280
Enantioselective induction of endocrine system related gene transcription by permethrin enantiomers in embryo zebrafish *(Danio reio)*

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Despite recent studies on enantioselectivity in acute aquatic toxicity of permethrin (PM), enantiomer-specific activity in endocrine disruption has been the subject of only limited research. In this study, we found that the mRNA levels of Vtgs, ERs and Thrs, which are related to the gonad and thyroid endocrine system, were greatly affected in newly hatched zebrafish when the embryo was exposed to PM racemate and its enantiomers at various concentrations (0.1, 0.5, 2.5, and 12.5 μg/L). The mRNA levels of the above mentioned genes were higher when the exposed PM concentration increased. Moreover, significant differences were detected among the enantiomers in inducing the endocrine system related gene expression. Specifically, the (-)-*trans* enantiomer induced Vtgs, ERs and Thrs mRNA levels more than 3 times higher than the (+)-*trans* enantiomer did. The results strongly indicate the occurrence of significant enantioselectivity in disrupting the endocrine system by PM enantiomers.

AGRO 281
Induction of genes related the innate immune system by permethrin enantiomers in embryo zebrafish (*Danio rerio*)

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Enantioselectivity in the toxicology and biodegradation of chiral pesticides has become a groundbreaking topic recently. In this study, effects of permethrin (PM) enatiomers on the induction of genes related to innate immune system of zebrafish have been carried out. We found that the mRNA levels of TNFa, IFN, IL-1β were affected in newly hatched zebrafish when exposed embryo to PM racemate and its enantiomers at various concentrations (0.1, 0.5, 2.5 and 12.5 μg/L). High concentration of PM (12.5 μg/L) significantly increased the mRNA levels of all these cytokines, exhibiting heavy impacts on the innate immune system of zebrafish. Moreover, significant differences were detected among the enantiomers in inducting the gene expression of the innate immune system. Of the four enantiomers, the (–)-*trans* enantiomer showed the greatest immune toxicity. The results strongly indicate the occurrence of significant enantioselectivity in immune toxicity of PM enantiomers.

AGRO 282
Synthesis and antiviral bioactivities of novel chiral bis-thiourea-type derivatives containing α-aminophosphonate moiety

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Chiral thiourea exhibit a wide range of functional and biological activities such as highly enantioselective catalysts for asymmetric carbon-carbon bond forming processes, antiviral agent, antitumor agent, anti-HIV agent, fungicide and non-nucleoside inhibitors. A large volume of researches on their synthesis and functional and biological activities has been reported during the last ten years. In continuation of our research program of chiral thiourea derivatives as

antiviral agent, we designed and synthesized a series of novel chiral bis-thiourea-type derivatives containing an α-aminophosphonate moiety **10a-l** (Figure 1) which can be prepared from 1-((1*R*,2*R*)-2-aminocyclohexyl)-3-substituted thiourea (**3a-c**) and substituted isothiocyanate (**9a-d**). The bioassay revealed that the chiral compound **10h** possessed good curative bioactivities (inhibitory rate = 58.6%) at 500 μg/mL against CMV *in vivo*, compareable to that of the standard reference (56.7%). Compounds **10a**, **10e** possessed good curative bioactivities (inhibitory rate = 57.6, 56.9% respectively) as the commercial product Ningnanmycin (52.3%) at 200 μg/mL against TMV *in vivo*.

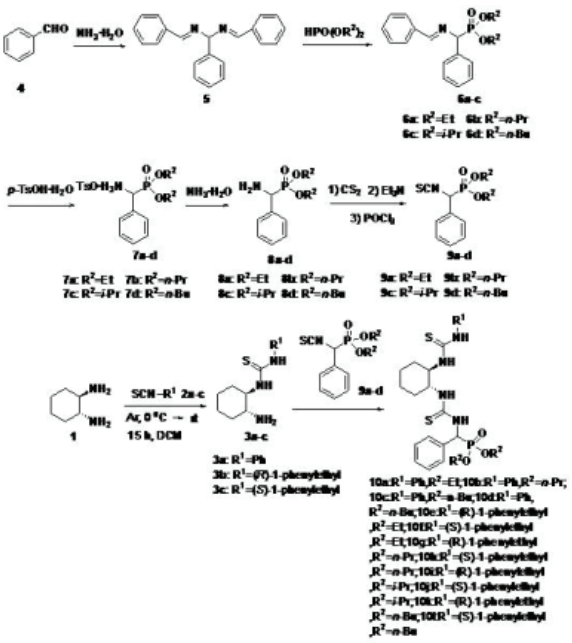

Figure 1. Synthetic Route to Chiral Bis-thiourea-type Analogues **10a-l**

AGRO 283
Phase distribution of PBDEs in sediment-water-DOM systems

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Polybrominated diphenyl ethers (PBDEs) are synthetic organic chemicals used extensively as additive flame-retardants. PBDEs are extremely hydrophobic compounds and recent finding of their occurrence in downstream surface waters suggests a particular transport mechanism. As with other hydrophobics polluants, dissolved organic matter (DOM) may act as a transport agent for the offsite movement of PBDEs. However, little is known about the effect of DOM on sorption and mobility of PBDEs in processes such as surface runoff. The aim of this study was to simulate a three-phase natural aquatic system to evaluate the effect of DOM on the partitioning of PBDEs (BDE-47, 99, 153 and 209). Sorption to DOM (K_{DOC}) and to sediment (K_{OC}) were measured from simultaneous determination of freely dissolved concentration (C_{free}) by SPME and the apparent aqueous-phase concentration (C_w) by liquid-liquid extraction. The results showed that DOM increased the apparent partition of PBDEs from the sediment phase to the solution phase and that the interaction depended on both the DOM sources and the PBDE compounds.

AGRO 284
Potential contribution of pyrethroids and fipronil to toxicity observed in sediments from an urban estuary

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Synthetic pyrethroids and fipronil were analyzed in urban estuarine sediments that exhibited a range of toxicity to test invertebrates. Sediments collected from a coastal waterway listed as impaired by regulators were analyzed by gas chromatography with electron capture and negative chemical ionization mass spectrometric detection (GC-ECD and GC-NCI-MS). Samples contained total pyrethroids as high as 470 ng/g with permethrin, bifenthrin and cypermethrin as the most abundant compounds. In contrast, fipronil and its three major environmental degradates were detected at much lower levels (0.16 to 16 ng/g). Toxic units (TUs) for these current use pesticides revealed that bifenthrin and cypermethrin, and not fipronil, were likely contributors to mortality observed in 10-day toxicity tests using the estuarine amphipod *Eohaustorius estuarius*. Prediction of toxicity based on TUs, however, is highly species dependent, and the levels of fipronil and it degradates in this study could be cause for concern for other target species.

AGRO 285
Untargeted analysis of organic contaminants in dolphin blubber using DSI-GC×GC/TOF-MS

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The high body burden of legacy chemicals such as PCBs and DDTs in marine mammals is of concern. However, most studies are targeted and have focused on a single or a few groups of known chemicals, despite the fact that in reality marine organisms are exposed to a mixture of numerous chemical groups. To assess this exposure to a mixture of both known and unknown organic contaminants, we developed an untargeted analytical approach using two-dimensional gas chromatography with time-of-flight mass spectrometry and direct sample introduction. We analyzed the blubber of a dolphin (*Delphinus delphis*) which was fatally stranded in January 2006 in Orleans, Massachusetts. More than 200 halogenated organic compounds were detected in the blubber. Flame retardants, halogenated natural products, degraded man-made compounds, and legacy chemicals were identified. Additionally, the potential chemical structures for the unknown peaks detected in the blubber will be discussed based on their mass spectra.

AGRO 286
California State Water Resources Control Board recycled water policy: Constituents of emerging concern expert panel

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The State of California Water Resources Control Board (SWRCB) Recycled Water Policy mandated the establishment of an expert panel to develop recommendations regarding monitoring of constituents of emerging concern in recycled water. The Southern California Coastal Water Research Project has entered into a contract with the SWRCB to convene this panel. This presentation will address the

SWRCB policy regarding recycled water and constituents of emerging concern. The charge of the panel and the potential regulatory actions that will follow the report of the panel will be discussed.

AGRO 287
The ocean is not forgotten: Integrating California's CEC approach

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The Ocean Protection Council seeks to reduce the chemical or biological byproducts and physical waste that may be delivered to the ocean. Through resolutions and projects, the OPC supports research and coordinates efforts among state agencies. The OPC Resolution to Reduce Toxins (2009) connected activities by the Department of Toxic Substances Control and the State Water Resources Control Board. Using a Blue Ribbon Task Force for scientific guidance, the three agencies are collaborating to identify and develop reduction strategies for CECs. This creates an opportunity to coordinate activities on CECs by federal partners such as the Environmental Protection Agency and the National Oceanic and Atmospheric Administration. Successful integration of these efforts will be essential to develop a complementary and comprehensive CEC reduction program.

AGRO 288
Emerging contaminants: Prioritization considerations for water reuse in California

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In January 2008, the Groundwater Replenishment System (GWR) in Orange County California started producing approximately 70 million gallons of drinking water per day from secondary treated wastewater. An additional 30 million gallon per day capacity expansion is currently planned. With the advent of the GWR System, the Orange County Sanitation District has been in the cutting edge of source control, implementing a first-of-a-kind program for assessing and prioritizing emerging contaminants, designed to protect the GWR System and its product water for Orange County. The emerging contaminant prioritization methodology has been applied to an initial, comprehensive list of both regulated and unregulated constituents. The prioritization process takes into account the pollutant source, available toxicity data, and treatment facilities design to focus on those constituents which have the potential to affect the treatment facilities and product water. Prioritization methodology and results will be discussed for regulatory action and research needs.

AGRO 289
Towards an early warning system for contaminants of emerging concern (CECs): A multiagency Mussel Watch pilot study in California

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To expand the relevance of the National Status & Trends Mussel Watch program to regional, state and local stakeholders, NOAA has entered into a partnership with federal and California agencies to incorporate contaminants of emerging concern (CECs). This "California pilot study" will target several classes of CECs, including pharmaceuticals and personal care products, current use pesticides and household chemicals of concern. Mussels from more than 70 coastal sites in California will be collected in 2009-10 and analyzed for this new breed of contaminants. In addition, passive sampling devices and/or caged bivalves will be deployed at selected locations to increase program flexibility in terms of analytes captured and spatial coverage. This pioneering study will inform state and local decisions on the pervasiveness and magnitude of CEC contamination in California's coastal ecosystems, and will serve as a model for prioritizing CECs within the region and across the nation.

AGRO 290
Prioritization of emerging contaminants for management response: Pesticides example

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In response to the long history of water quality problems associated with pesticide use and the rapid market shifts occurring as a result of U.S. EPA's pesticide reregistration process, California agencies have developed several different prioritization schemes for pesticides. These prioritization systems are employed to determine both research and regulatory priorities. Prioritization schemes developed by the Central Valley Regional Water Quality Control Board, the Sacramento Watershed Protection Program, the California Department of Pesticide Regulation, and the Urban Pesticide Pollution Prevention Project (a collaboration of California Water Boards, wastewater, and urban runoff management agencies) will be reviewed.

AGRO 291
Complexities surrounding the environmental impact of drug disposal

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The excretion of active pharmaceutical ingredients (APIs) via urine and feces is considered the primary route by which APIs from human pharmaceuticals enter the environment. Disposal of unwanted, leftover medications by flushing into sewers has been considered a secondary route. The present study presents a comprehensive examination of alternative routes of API release to the environment. These include bathing, washing, and laundering, all of which release APIs remaining on the skin from the use of high-content dermal applications or from excretion to the skin via sweating. Understanding these routes is important from the perspective of pollution prevention, because actions can be designed more easily for reducing the environmental impact of APIs compared with the route of direct excretion, for reducing the incidence of unintentional and purposeful poisonings of humans and pets, and for improving the quality and cost-effectiveness of health care. Overall, unintentional exposure to APIs for humans via these routes is possibly more important than exposure to trace residues recycled from the environment in drinking water or foods.

AGRO 292
Conceptual model for transport of pesticides used in urban areas into surface waters

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A conceptual model of the transport of pesticides from urban areas to surface waters has been developed. This model is based on a review of scientific and engineering literature, pesticide product labels, California pesticide sales and reported use data, pesticide user surveys conducted by the University of California and others, and unpublished data from municipal urban runoff programs and municipal wastewater treatment plants. The conceptual model categorizes urban pesticide application patterns and identifies the pathways linking legal pesticide applications—and common inappropriate activities—with surface waters. The model was developed to serve as a tool to prioritize use patterns, formulations, and transport mechanisms for further investigation to address significant gaps in knowledge and to develop measures to prevent and to respond to water quality and compliance problems associated with urban pesticide use. Application of this model to inform management responses to toxicity attributed to pyrethroid insecticides will be discussed.

AGRO 293
Transport of insecticides to urban streams in California: A refined conceptual model and problem formulation

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The California Department of Pesticide Regulation has instituted a re-evaluation of pyrethroid insecticides and a substantial fraction of the studies requested as part of this program relate to urban pyrethroid uses. The re-evaluation was in response to various academic and industry studies which detected pyrethroid insecticide residues in depositional sediments in streams dominated by urban land uses. Over the last 2 years, the Pyrethroid Working Group (PWG) has been addressing re-evaluation requests. Recent findings from PWG and other programs have indicated that the conceptual model underlying the contributions of various potential routes of exposure should be refined. As a result, PWG has consulted with stakeholders and others to prepare a revised conceptual model which has refocused the problem formulation and analysis plan leading to new study designs. Issues to be discussed include the lack of spatially-specific urban use data, the impact of urban creek sediment sampling methodologies and some of the complexities of urban study design. In addition, due to spatial heterogeneity, the potential ecological significance of residues detected in depositional sediments needs to be distinguished from potential impacts of residues found in the water column.

AGRO 294
Advances in modeling urban/residential pesticide runoff

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The U.S. Environmental Protection Agency's (USEPA's) Storm Water Management Model (SWMM) is widely used for urban water management and water quality analysis. The model is limited in its ability to simulate pesticides because of a general lack of knowledge of washoff coefficients values for hard surface runoff and the inability to specify discrete pesticide applications. USEPA's Pesticide Root Zone Model (PRZM) was to developed to simulate pesticide runoff and leaching in agricultural environments and is limited in its ability to urban drainage features. This paper presents recent enhancements to both models to overcome these deficiencies. Pesticide and water runoff predictions from both models are compared.

AGRO 295
Urban pesticide use support system

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The California Department of Pesticide Regulation's (DPR's) Pesticide Use Reporting (PUR) database provides detailed information on agricultural pesticide use and is an invaluable resource in understanding the spatial and temporal variability in pesticide use in California. Similar information is needed to allow DPR and other stakeholders to conduct local and watershed risk assessments for urban and residential use of pesticides. A geostatistical tool is presented to convert county-level estimates of urban/residential pesticide use into a database having a similar level of resolution to the PUR. The tool utilizes statistical distributions on that characterize application practices and frequency for different demographical environments (e.g. low density urban, medium density urban, recreational facilities, etc.). Sources of information include product labels, surveys, case studies, and interviews with professional applicators, pesticide manufacturers, and other experts. A geographical information system (GIS) is used to convert county-level estimates of a particular pesticide into estimates at the MTRS (meridian/township/range/section) by spatial assignment to detailed land use and census information.

AGRO 296
Use of a storm water management model for diagnosis of residential exposure issues

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Many products are available for use by homeowners to protect and beautify their lawn and gardens. However, careless use or miss understanding the intended use can sometimes lead to unintentional contamination of waters leaving residential areas. Finding the causes of unintentional exposures can often be difficult to determine, and therefore hampers stewardship efforts. We use an urban/suburban storm water model (SWMM) in an effort to discover which conditions most likely contribute to chemical micro constituents being found in storm drain water samples. Modeling results are compared to monitoring results from a UC Cooperative Extension program. One conclusion from this work is that the use of a model such as SWMM can be helpful as a diagnostic tool for determining exposure contributors in residential areas. A series of mitigation practices will be developed based on this effort.

AGRO 297
Modeling the effects of landscape best management practices on water quality in urban residential areas

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This study evaluates both wet and dry weather loading from residential drainsheds in a Mediterranean climate. High-resolution flow data and weekly constituent concentration data from over a year of continuous monitoring are used to characterize runoff and estimate loading from low and very low density residential zones in Sacramento County, CA. An empirical model incorporates neighborhood monitoring results and data from experimental landscapes to estimate annual loads and assesses the potential for best management practices to reduce regional loading. Results are compared to traditionally derived wet weather-only projections. While storm runoff contributed greater loads per unit time, 92% of days during the study period were fair weather and substantial loading occurred during such periods. Traditional loading estimates commonly overlook these loads due to their exclusive focus on storm runoff.

AGRO 298
Pesticide detections in washoff from residential hardscapes generated at defined intervals

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The detection of pesticides in urban water ways has led to concerns that homeowner activities may be responsible for the transport of these chemicals into storm drains. Irrigation runoff is the most obvious dry weather method of pesticide transport into storm drains. Additionally runoff from washing off hardscape surfaces, such as driveways and sidewalks, could also be a significant source from residential landscapes. Three experimental landscapes, each possessing a different level of low impact design features to reduce runoff to the street, received a professional application of fipronil to the perimeter of the home and a hose-end homeowner application of bifenthrin to the front lawn area. Twenty-four hours later the driveway and sidewalk of each landscape were washed down. Surface runoff samples were collected and analyzed for fipronil and bifenthrin concentrations. This process was repeated at 7, 14, 21, 28, and 56 days following the original application of the pesticides.

AGRO 299
Outreach and training for professional and non-professional pesticide applicators for urban pesticide runoff mitigation

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Pesticide detections in urban waterways have created a need for educating pesticide users about ways to protect the environment. Alternatives include reducing the amount of pesticides used through pest prevention, changing to alternative pesticides, modification of how and when applications are made, or employing a combination of these as part of an integrated pest management (IPM) program. We have developed educational programs for professionals and consumers that include web-based training sessions and online videos, easy-to-use pesticide quick tip cards, touch screen computer kiosks, and workshops. We primarily focused on pesticide reduction as related to ant control because this pest was identified as the reason most consumers contracted with a pest control company or applied pesticides themselves. Also, pyrethroids and other insecticides used to control ants have been widely detected in waterways throughout California.

AGRO 300
Effects of the atomization process on spray quality

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The application of pesticides is a critical part of the pest control process. Whether it is the control of soybean rust, bollworms, or broadleaf weeds, the ultimate goal is to achieve efficacy from the pesticide while reducing drift or off-target deposition. The new DRT regulations concerning buffer zones, spray quality and DRT certified technologies (both equipment and adjuvants) will be a challenge for the Crop Protection industry. Pesticides and tank mix additives have an effect on the atomization process with any nozzle. The percentage of driftable fines will be a major component of the DRT certification process. Ultimately the atomization process will dictate the final spray quality and this will be responsible for the potential efficacy of the pesticide.

AGRO 301
Low volume application of insecticides for the Asian citrus psyllid management in Florida

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The Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama, is an important pest of citrus crops around the world. It is the vector of three bacterial species in the genus *Candidatus* Liberibacter that are the presumptive causal agents of the most destructive disease of citrus, Huanglongbing (HLB) or greening disease. Citrus growers in Florida are applying 6-20 insecticide sprays per year to suppress the ACP populations and to contain HLB disease spread within and between groves. Therefore, novel spray technologies that are fast, inexpensive and provide equal or better control of the target pest to existing technologies are needed by the citrus industry to improve economics of ACP control. In this regard, low volume application of insecticides with specialized equipment has shown promise in Florida citrus production. In this paper, we discussed the potential of this technology in managing ACP populations in the field based on the research findings from our laboratory and field investigations on ACP.

AGRO 302
Air-assisted, electrostatic-induction, crop-spraying technology: Review of basic physics and engineering underlying the reduced-volume, reduced-diameter droplet deposition process

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Sustainable and effective crop production requires implementation of alternative spray application technologies which, as compared to conventional hydraulic-nozzle technology, dispense significantly less (*e.g.,* 1/4-1/2) pesticide active ingredient into the ecosystem while achieving the required on-target deposition for economic/efficacious pest control. This review summarizes the underlying physics and engineering development of one such hybrid air-assisted electrostatic technology, proven over the past several decades at the University of Georgia, which: a) purposefully atomizes reduced volumes (*e.g.,* 10-60 L/ha) of conductive (*e.g.,* 10^{-4}-10^{1} S/m) spray liquids into small droplets (*e.g.,* 30-40 mm VMD); b) imparts to them high droplet charge-to-mass (*e.g.,* 10 mC/kg) *via* an electrostatic-induction electrode embedded within the nozzle safely using low-voltage/low-power (*e.g.,* 1 kV/1 watt) electronics; c) aerodynamically propels (~ 3-6 m/s) the charged spray cloud to the target plant canopy and turbulently mixes it therein *via* an air-carrier stream (~300 watts) inherent within the pneumatic nozzle; and d) incorporates primarily space-charge electric force fields (~1-3 kV/cm) emanating from the charged cloud itself for depositing the charged spray onto the frontsides/backsides of interior-canopy surfaces under droplet forces typically 10-50 fold greater than gravitational, thus precluding the non-penetrating “fringing” of deposition onto exterior surfaces of “Faraday-shielded” plants characteristic of purely electrostatic crop sprayers relying upon high-voltage (*e.g.,* 40-90 kV) electrodes external to the nozzle. Also reviewed will be electrical interactions occurring between target plants and incoming charged-spray clouds which verify target-grounding adequacy, on-target mass-transfer and pest-control results typically 2-5 times greater for electrostatic deposition *vs.* conventional, as well as backside deposition enhancements.

AGRO 303
Generalised dose adjustment calculator for orchard spraying

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Pesticide Adjustment to the Crop Environment (PACE) research for orchard spraying applications has demonstrated that efficiency of pesticide use can be significantly improved by adjusting the label recommended dose to give more uniform levels of deposit across a wide range of practical tree-fruit structures. Here we introduce a new web page form for calculating label dose-rate adjustment. The approach is an extension of UK PACE scheme for optimising the adjustment of reference sprayer settings to different orchard structures. The web page form is supported by a small database of standardized reference crop structures to represent practical examples of the most efficient use of pesticide at the label dose-rate. The web page is also supported by a generalised quantitative model of dose adjustment which serves to extend the efficient use of registered pesticide dose-rate to a wide range of orchard structures of different size and density (planting, branching and foliar development). A demonstrator version of the new web page has recently been made available for assessment by the research community. This version handles the different methods of label dose-rate expression that are in common use throughout Europe in addition to the ground-area based dose-rate method used in the original UK version. However, at this stage of development the pictographs that support dose adjustment for orchard density are based on UK examples of apple trees. It would improve the general accuracy of dose adjustment if the reference crop structures within the database were also used by regulators and the agrochemical manufactures within different countries to evaluate efficacy and environmental fate as part of the pesticide registration.

AGRO 304
Using drift reduction adjuvants to increase deposition of pesticides

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Garrco Products Inc. continues to work with aerial and ground pesticide application industries to develop and deliver spray adjuvants that are superior, functional, and economical for the end user. Customer needs and market trends drive research and product development efforts. Garrco Products Inc. is a research, manufacturing, and marketing company, specializing in pesticide spray adjuvants that enhance pesticide application efficiency; we also market other types of adjuvants across a wide range of purposes. We private label products, develop custom formulations and do research for many different applications. Efficacy testing is an important process for product development. Results are reported to applicators during their annual training meetings and various trade shows. This paper discusses using adjuvants to enhance pesticide efficacy by increasing deposition which ultimately reduces spray drift.

AGRO 305
Reality check: Current practices in pesticide application and management of pesticide waste
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Pesticide application requires more management skills than all the other field operations which the farmers practice to grow crops. Equipment must be calibrated frequently, and malfunctioning parts must be replaced. Leftover pesticides and pesticide containers must be handled properly. This paper will discuss how these practices are followed by the pesticide applicators in the U.S.

AGRO 306
Biomimetic chemistry as a useful tool for studying reactive metabolites of pesticides

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Most organophosphate (OP) pesticides require metabolic activation before attacking the target site, as opposed to chemical nerve agents, such as VX and Sarin, which inhibit the enzyme directly. The majority of OP pesticides exhibit weak anticholinesterase activity *in vitro* compared to their *in vivo* activity. Biooxidation, involving various drug metabolizing enzymes (DME), depending on the S- and N-moieties present in the molecule, is probably the principal route by which these pesticides are activated or detoxified. The oxidized product, usually a short lived intermediate, may either hit the target directly or hydrolyze rapidly or, following rearrangement, convert to another species with enhanced reactivity (metaphosphate, carbene) or lose its phosphorylation or carbamoylation properties. Modeling DME-mediated oxidations may lead to prediction of a pesticide's potential to cause adverse reactions. Studying the bioactivation mechanism involves the use of low molecular weight oxidants, such as m-chloroperoxybenzoic acid, t-butylhydroperoxide and others. The organic reactions are exemplified with some representative experiments, carried out at ECTL (Environmental Chemistry and Toxicology Laboratory) in Berkeley, and their relevance is discussed in terms of actual pesticide activity

AGRO 307
Legacy of environmental and metabolic activation

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John Casida's laboratory at Berkeley has a rich legacy of discovery in the areas of environmental and metabolic activation of chemicals. The achievements of Professor Casida and his colleagues in these areas will be reviewed. Model oxidation reagents (notably *m*-chloroperoxybenzoic acid and superoxide) as well as photochemical reactions were staples for the production of reactive species, notably from pyrethroids and polyhalogenated molecules. Model oxidants were used to prepare nitrosamine intermediates from formamidine insecticides and chloroacetanilde herbicides. The Casida Laboratory frequently employed the parallel use of chemical characterization and assay of biological reactivity via the Ames Assay with great success. In addition, use of high resolution NMR to identity reactive intermediates (e.g. thiiranium ions from sulfur mustards and epoxyfurans from furan-containing fungicides) was a successful tactic of the Berkeley research group.

AGRO 308
Metabolism and toxicological studies of environmental chemicals: From chemical and microsomal oxidation reactions to metabolism reactions in transgenic plant cell cultures containing the mammalian p450 monooxygenase system

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The herbicidal activity of *S*-alkylthiocarbamates and the mutagenic activity of e.g. the herbicide diallate, a *S*-(2,3-dichloroallyl) thiocarbamate are in agreement with the reactivity or decomposition products of their metabolically-formed sulfoxides. The oxidation can be mimicked using m-chloroperoxybenzoic acid. Diallate sulfoxide e.g. undergo a spontaneous [2,3] sigmatropic rearrangement to give a *S-O-(*dichloroallyl) thiocarbamate sulfenate ester followed by an additional 1,2-elimination reaction resulting in *N,N*-dialkylcarbamoyl-sulfenylchloride and 2-chloroacrolein. Diallate proved to be a promutagen in the Salmonella typhimurium "Ames" assay; however it is only mutagenic on metabolic activation using a liver microsomal mixed function oxidase system (S9 mix). Diallate sulfoxide represents the proximate mutagen while 2-chloroacrolein forms the potent ultimate mutagen. Model systems have been further developed and standardized to study biotransformation processes using plant cell cultures. Human CYP1A1, CYP1A2 and CYP3A4 or insect CYP6G1 were heterologously expressed in cell cultures for oxidative metabolic profiling to mimic mammalian metabolism processes or elucidate formation of insecticide resistance in insects.

AGRO 309
NMR at the PCTL in Berkeley in the 1980s and beyond

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In 1982 the Casida laboratory at Berkeley was funded to buy its own high field 300 MHz wide bore NMR spectrometer. The acquisition of this instrument allowed the group to embark on research projects which were previously impossible or impractical and opened up a new era for the laboratory. This talk will describe some of the first investigations which were carried out on the instrument in the early 1980's on organo-phosphorus insecticides, pyrethroids and ryanoids. This latter work led to further studies on the ryanodine receptor and the discovery and characterisation of a whole family of new related compounds. NMR spectrometers have changed enormously since those days and the talk will then move on to more current NMR work on trace level analysis of environmental samples and the technical problems associated with this.

AGRO 310
Proteomics in bacterial metabolism of pesticides

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Microorganisms have an exceptional ability to exploit inorganic or organic chemicals such as pesticides for their growth, being the basis of bioremediation. Eight novel *Arthrobacter*, *Burkholderia*, *Mycobacterium*, and *Sinorhizobium* bacterial species were recently isolated from soils. The isolated strains can degrade a wide range of pesticides and aromatic compounds. Comparative mass spectrometry-based metabolomics and proteomics showed the metabolic pathways and mechanisms of degradation of the aromatics. The biodegradation pathways can be broadly

divided into peripheral and central pathways. The peripheral pathways that are normally initiated by dioxygenases convert pesticides into various metabolic intermediates such as catechol and protocatechuate. In the central pathways, the intermediates undergo further metabolism to enter the tricarboxyli acid cycle. Application of proteomics provides insights into global protein responses to xenobiotics and networks among diverse metabolic pathways. This work is an extension of the metabolism and receptor work done in Professor John Casida's laboratory.

AGRO 311
Plant peroxygenase: From detoxication to signalling

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In plants, xenobiotic detoxication is achieved mainly by two distinct hemoproteins, namely members of the cytochrome P450 and peroxygenase (PXG) families. While cytochromes P450 use molecular oxygen, peroxygenases incorporate one atom of oxygen originating from hydroperoxides. Peroxygenases catalyze the reduction of hydroperoxides followed by co-oxidations such as hydroxylation, sulfoxidation or epoxidation reactions which proceed with high degrees of regio- and stereoselectivity. *In planta*, in association with epoxide hydrolases, peroxygenases constitute one branch of the so-called "lipoxygenase pathway", which leads to the production of numerous oxylipins such as epoxide and hydroxyl derivatives of unsaturated fatty acids. We have recently identified a peroxygenase as caleosin, i.e. a member of a Ca^{2+}-binding protein family of hitherto unknown functions. By using microarrays, co-expression analysis and loss- and gain-of-function strategies, we have demonstrated that one of these peroxygenases/caleosins is involved in stress signalling, for which its reaction products play a crucial role.

AGRO 312
Theoretical molecular descriptors relevant to the uptake of persistent organic pollutants from soil by zucchini: A QSAR study

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The uptake of persistent organic pollutants (POPs) from soil by plants allows the development of phytoremediation protocols to rehabilitate contaminated areas. An evaluation is given on the molecular properties of POPs in terms of theoretical molecular descriptors relevant to the uptake from soil and pharmacokinetic behavior in plants. Diverse theoretical descriptors have been reported in the literature employed as independent variables for developing quantitative structure-activity relationship (QSAR) models for predicting the bioconcentration factors (BCFs) of POPs in plants. In this study, statistically significant linear regression models have been developed for the BCF values of 20 polychlorinated dibenzo-p-dioxins/dibenzofurans and 14 polyhalogenated biphenyls in two zucchini varieties based on retrospective data. The relevant parameters have been selected from a set of 1666 DRAGON descriptors. The best regression model, including GETAWAY- and WHIM-type descriptors, displays the following statistical parameters: n = 34, r^2 = 0.892, F = 59.95, q^2 = 0.756.

AGRO 313
Endocrine disruptors and pharmaceuticals in California coastal waters

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Population increase, climate change and ecological conservation have put an unprecedented demand on water resources, particularly in areas impacted by drought. In California, the utilization of sea water and recycled water to meet potable water needs is fast becoming a reality. While reverse osmosis (RO) product water contain only minute traces of emerging contaminants, treated wastewater effluent and concentrated RO brine solutions that are discharged to the coastal ocean raise several concerns. For the past decade, monitoring for suspected endocrine disrupting chemicals (EDCs) and pharmaceuticals has been undertaken to understand the loading of emerging contaminants to California's coastal waters. Treated wastewater discharged to the Southern California Bight were found to contain ug/L levels of several EDCs and pharmaceuticals, including naproxen, atenolol and gemfibrozil. Steroid hormones in these effluents exhibited concentrations up to 90 ng/L. Ambient concentrations were orders of magnitude lower, reflecting the degree of mixing with ocean waters.

AGRO 314
Determination of pharmaceuticals in nearshore marine sediment samples from the Southern California Bight

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Many coastal urban marine ecosystems receive liquid and solid discharge from wastewater treatment, which removes a substantial fraction of the total contaminant load, but was not designed to efficiently remove trace concentrations of pharmaceuticals and other contaminants of emerging concern that typically are present. Coastal marine sediment is a likely sink for pharmaceuticals that adsorb to solids by hydrophobic or other interactions and were the subject of study at sites proximal to discharges within the Southern California Bight. Grab samples of surficial sediment were collected, chilled immediately after collection and then frozen prior to analysis. Thawed wet sediment aliquots were extracted by using pressurized liquid extraction with a water/acetonitrile mixture. Following extraction, an aliquot of the sample extract was analyzed by HPLC/MS/MS, using selected reaction monitoring for 28 pharmaceuticals. Trace (low ng/g) concentrations of several pharmaceuticals, including carbamazepine and diphenhydramine. Were observed in several samples. Additional analyses are underway.

AGRO 315
Emerging contaminants and trace organics in wastewater and solids at the San Jose/Santa Clara Water Pollution Control Plant

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Emerging contaminants are a broad class of compounds that include personal care products, pharmaceuticals, and trace organics. Information on the environmental occurrence, pathways, and loadings of these compounds is scarce. One pathway some of these compounds travel into environmental media is through wastewater treatment plants (WWTPs). The San Jose/Santa Clara Water Pollution Control Plant (Plant) is a large, 167 MGD capacity advanced treatment WWTP located in South San Francisco Bay in California. City of San Jose staff collected wastewater and digested solids samples from three process locations during three sampling events from the Plant. Aqueous and solids samples were analyzed for concentrations of Pharmaceuticals and Personal Care Products, Steroids and Hormones, Multi-residual Pesticides, and Polybrominated Diphenyl Ethers using EPA Methods. The objective was a basic characterization of microconstituents entering and leaving the Plant to provide information to wastewater managers and scientists for prioritizing future studies, public outreach, pollution prevention or source control efforts. Of the 165 analytical endpoints measured in this study, 114 were either not detected or not quantifiable. Of the 51 quantifiable analytical endpoints, most (40) were removed or reduced at 75%-99% efficiency through treatment. Based on average Plant flows and concentrations at the three process points, staff calculated a preliminary estimate of mass balance for the quantified compounds.

AGRO 316
Ubiquitous distribution of alkylphenols: The next emerging wave of endocrine disruptors along coastal waters

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While assessing the health of Morro Bay, California, we found gonadal and liver tumors in mud-dwelling arrow gobies that are indicative of exposure to organic pollutants. We analyzed goby livers for levels of more than 60 organic pollutants and heavy metals that are commonly found in estuaries along the Pacific coast of North America. We found moderately high levels of DDE and high levels of nonylphenol (NP). NP is a known endocrine disruptor and the degradation product of alkylphenol ethoxylates, which are widely used in industrial and household products. Further analysis of goby and oyster populations along the West coast showed high levels of NP in a number of estuaries. In order to detect the source of NP contamination we collected samples from two potential point sources. Our findings suggest that NP enters the estuary through the effluent of waste water treatment plants and septic systems and accumulates in sediment.

AGRO 317
High PCB and low PBDE exposures in pelagic North Pacific albatrosses

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Monitoring and protecting the health of the Earth's oceans is an imminent concern due to the pollution of man-made materials into them. To this end, levels of persistent organic pollutants (POPs), including polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs), were measured in serum of pelagic Albatrosses. Since Albatrosses are high trophic level consumers, we would expect them to have increased exposure to environmental contaminants *via* bioaccumulation. The sample population (n=57) consisted of 20 Black-footed (*Phoebatria nigripes*) and 21 Laysan (*Phoebastria immutabilis*) Albatrosses nesting on Tern Island, and 16 Laysan Albatrosses (*Phoebastria immutabilis*) nesting on Guadalupe Island. Our results indicate that North Pacific Albatrosses are highly exposed to PCBs, which showed both temporal decline and inter-species variation. In contrast, PBDEs were detected at trace levels, indicating these birds from the remote North Pacific Ocean have low PBDE exposure relative to PCBs.

AGRO 318
Status and trend of classic and emerging brominated flame retardants in California wildlife and their exposure pathways

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Our Environmental Chemistry Laboratory (ECL) has a long history of biomonitoring persistent organic contaminants (e.g., PCBs and PBDEs) from California aquatic and terrestrial wildlife such as fish, seal, tern, peregrine falcon, and urban rators. Following the extensive usage in a variety of consumer products as flame retardant, PBDEs are ubiquitous in the abiotic and biotic environments. Our recent peregrine falcon study showed that PBDE levels not only showed among highest levels of PBDEs in wildlife but also significantly increased (tripled each decade) over the past 22-year period. Interestingly, the gradient of levels and the patterns of PBDEs from terrestrial to aquatic ecosystem were obvious in California wildlife. For example, urban peregrine eggs had higher PBDE levels with BDE-209 and the higher brominated PBDEs (hexa-nona), while coastal eggs showed lower levels with BDE-47 and -99 dominant. These differences is likely to arise from differences in prey and, in turn from differences in diet of the prey birds based on our peregrine prey and stable isotope ($\delta^{13}C$, δD, $\delta^{15}N$) data. In addition, new BFR replacements including HBB and BTBPE were detected in the peregrine eggs (n=19), warranting for the continuous monitoring of both the classic and new alternative BFRs in aquatic and terrestrial food webs. Disclaimer: The ideas and opinions expressed herein are those of the authors and do not necessarily reflect the

official position of the California Department of Toxic Substances Control.

AGRO 319
Influence of sediment-amendment with single-walled carbon nanotube on microbial availability of polycyclic aromatic compounds

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The rapid growth in production and applications of carbon nanotubes (CNTs) raises serious concerns over the potential environmental impact of these materials. Due to the large surface area and high reactivity, CNTs are generally highly effective in sorption and sequestration of organic compounds, such as polycyclic aromatic compounds (PAHs), and may hence affect the bioavailability of PAHs in the environment. Meanwhile, surface properties and sorption capacity of CNT particles may be altered after interactions with ubiquitous dissolved organic matter (DOM). In this study, sediment was amended with single-walled carbon nanotubes (SWCNTs) or DOM-coated SWCNTs at various application rates to understand the effect of SWCNTs or coupling effect of DOM- SWCNT on bioavailability of PAHs. A respirometer system and polydimethylsiloxane (PDMS) coated fibers were used for the evaluation of microbial availability and chemical activities of PAHs. A coupled model considering both desorption and biodegradation processes was developed and used to evaluate the microbial availability of different forms of PAHs under the effect of SWCNTs.

AGRO 320
Enantioselective separation and analysis of synthetic pyrethroids

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Synthetic pyrethroid (SP) insecticides usually contain 1-3 asymmetric positions, making them chiral compounds with 1-4 pairs of enantiomers. SPs are generally separated and analyzed via chromatographic resolution, including capillary electrophoresis (CE), supercritical fluid chromatography (SFC), gas chromatography (GC), and high-performance liquid chromatography (HPLC). GC and CEC are more suitable for analysis of small quantities or concentrations. HPLC is the preferred method for enantiomeric separation and analysis, especially for analyzing larger, nonvolatile, polar, and thermally labile pesticides.

AGRO 321
Integrative assessment of enantioselectivity in environmental safety of modern chiral pesticides

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Chiral pesticides comprise a new and important class of environmental pollutants nowadays. The increasing release of chiral chemicals into the environment dictates attention to a better understanding of enantioselectivity in their human and ecotoxicological effects. Enantioselectivity of chiral pesticides has been considered in many recent studies, such as bioaccumulation, biodegradation, acute and chronic toxicities, and endocrine disruption. The close multi-directional interactions among the organizational systems, such as the endocrine system and the immune system, imply that modulation of one system by chiral pesticides may also affect another system. However, in almost all previous studies, different endpoints were assessed independently, and consequently our present knowledge of enantioselectivity is rather disconnected and random. Integrative assessment of enantioselective environmental safety of chiral pesticides in different organisms and models may improve the understanding of enantioselectivity in environmental toxicology of chiral pesticides. From our recent studies, 1*R*-*cis*-bifenthrin (1*R*-*cis*-BF) possesses stronger toxic effects to organisms (*Pieris rapae L.*) and *Daphania magna* than 1*S*-*cis*-BF by about 300-fold and 18-fold respectively. However, 1*S*-*cis*-bifenthrin (1*S*-*cis*-BF) showed stronger toxicity to mouse RAW264.7 macrophage, human amnion epithelial (FL), and human hepatocellular liver carcinoma (Hep G2) than 1*R*-*cis*-BF. These results indicate that the enantioselective toxicity and activity of BF between non-target organisms and target organisms were reversed. For lambda-cyhalothrin (LCT), (-)-LCT not only displayed the stronger immunotoxicity to macrophage cells (RAW264.7), but also possessed greater estrogenic activity than its counterpart. The consistency was attributed to interplaying mechanisms in the closely interacting immune and endocrine systems. The underlying interplays suggest that other chiral xenobiotics may also show a directional enantioselectivity in immunotoxicity and endocrine toxicity. Given that many biological processes are interrelated, enantioselectivity may follow specific patterns that can be revealed via integrative assessments.

AGRO 322
Comparison of the enantiomer distribution of chiral organochlorine contaminants in captive West Greenland sledge dogs and East Greenland polar bears

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Captive West Greenland sledge dogs (*Canis familiaris*) have been studied as a surrogate Arctic apical predator species with respect to the bioaccumulation, fate and effects in organohalogen (OHC) exposed polar bears. In these studies the dogs were fed OHC-polluted minke whale blubber (exposed cohort) and pork fat (controlled cohort) diets. In the present study, OHC enantiomer composition were examined. Significant differences in enantiomer distributions of oxychlordane, heptachlor epoxide, PCB 91 and PCB 149 were found between diet and tissues, indicating that sledge dogs stereoselectively biotransformed these legacy OHCs. Furthermore, no differences were observed in the enantiomer distributions of the OC pesticides between females and pups, indicating that *in utero* and lactational transfer of these compounds was not stereospecific. Exposed cohort dogs have been shown to have comparable variations in several biomarker endpoints (e.g., endocrine and immune system) as those reported for wild polar bears from East Greenland. Stereoisomer analysis of OHCs on polar bears showed that comparative bioaccumulation and biotransformation between species in the field was due to species-specific metabolism of OHCs.

AGRO 323
Phytotoxicity and environmental fate of chiral herbicides

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Growing concern about the side effects of herbicides on non-target organisms and natural resources has promoted the use of stereo-chemically pure or enantiomerically-enriched compounds. The enantioselectivity in phytotoxicity and environmental effects of herbicides has recently been the focus of much research and is becoming better understood. Because of their different biological properties that selectively interact with biological systems, enantiomers of chiral herbicides can be regarded as different substances. It is necessary to study toxicities, metabolic conversions and migration issues at the chiral level to predict the exact herbicidal effects and pollution load. Here, we summarize the preparation technology of optically pure enantiomers and their enantioselective effects on plants and the biotransformation effects of the main chiral herbicides. The review provides a basis for further study of the chemical and biological behaviors of chiral herbicides. We also address research in the manufacture of optically pure or enantiomerically enriched herbicides with higher efficiency and fewer side effects.

AGRO 324
Enantiomer selective estrogen and androgen activity of chiral pesticides

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A number of chiral pesticides are hormone active with endocrine disrupting potential. We present the *in vitro* estrogen and antiandrogen activity of the individual enantiomers of the pesticides: o,p'-DDT, o,p'-DDD, o,p'-methoxychlor, a-chlordane, b-chlordane, heptachlor, ruelene and Fipronil. Optically pure samples and racemic mixtures were evaluated for estrogen receptor binding, reporter gene, endogenous gene, and cell proliferation activity as well as androgen receptor binding and reporter gene activity. With the exception of heptachlor, all racemic mixtures and pure enantiomers tested were found to have some estrogen agonist activity with a number of specific enantiomer selective induction effects observed. All test compounds except heptachlor displayed antiandrogen activity with some enantiomer selective antiandrogen activity observed. This study highlights the importance of resolving the enantiomers of chiral pesticides for endocrine disruptor characterization. Also shown are significant differences between apical, in vitro endocrine determinations and measures of endogenous gene regulation.

AGRO 325
Enantioseparation of new quinazoline derivatives with α-aminophosphonate moiety on polysaccharide chiral stationary phases by high performance liquid chromatography

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This presentation discusses enantioseparation of some new quinazoline derivatives bearing α-aminophosphonate moiety under normal-phase conditions on two immobilized polysaccharide-based chiral stationary phases (Chiralpak IA and Chiralpak IC). The effects of two CSPs, polar modifier and column temperature on the retention time and separation factor were investigated. The results showed that IA column with IPA as polar modifier displayed the best enantioselectivity for most of the test compounds. On IA column, the plots of ln *α* and ln *k* against 1/T were highly linear and the elution order of two enantiomers was unanimous in the temperature range of 10-40°C. The semi-preparative separation of some compounds was executed successfully in n-hexane/IPA on the Chiralpak IA column. Samples were dissolved in mobile phase and the concentration was fixed at approximately 1.5-2.5mg/mL, and the injection volume was 4-8mL. Two fractions were collected: the first-eluting enantiomer was collected in F1 fraction and the second-eluting enantiomer was collected in F2 fraction. The analytical assessment of the enantiomeric excess values of all collected fractions was higher than 98%.

AGRO 326
Degradation and racemization of haloxyfop-methyl and free haloxyfop enantiomers in soil investigated by enantioselective HRGC and various mass spectrometric detection techniques

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Haloxyfop-methyl is a selective herbicide controlling grasses in various broad leaved crops. The compound was introduced into the market as racemate and later replaced by the enantioenriched "haloxyfop-P-methyl" mainly consisting of the R enantiomer which carries the desired biological activity. We investigated the sequence of ester cleavage and racemization of R and S methyl ester and acid in soil with and without the presence of D_2O and under sterile and non-sterile conditions. We show, that the ester hydrolysis is not enantioselective, that the S acid is rapidly converted in active soil into the herbicidally active R acid and that these processes are mainly biologically mediated. In the presence of D_2O, a significant exchange of selected protons in the molecule could be observed. We used enantioselective HRGC on a permethylated -cyclodextrin column coupled to a GC-MS/MS to resolve the haloxyfop-methyl enantiomers and the acid enantiomers after conversion to their ethyl esters.

AGRO 327
Enantioselective transformation of prochiral and chiral agrochemicals as well as of emerging environmental pollutants by microorganisms

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Laboratory trnasformation experiments were performed with a microbial community obtained from marine sediment and water of the North Sea. In the case of *rac*-α-HCH, both enantiomers are transformed to the respective β-PCCH

enantiomer, however, with different velocities, thus leading to enantiomeric excesses of the first eluting β-PCCH enantiomer. The prochiral γ-HCH is being transfromed to *rac*-γ-PCCH. The results are in line with data from the eastern part of the North Sea, while different microbial communities in the western part of the North Sea give rise to an opposite transformation preference. The further enantioselective transformation of the PCCHs were also studied herein as well as of the chiral phenoxyalkanoic acid herbicides DCPP and MCPP, where the micronial marine culture was able to transform exclusiveliy the *R*-enantiomer, while the concentration of the *S*-enantiomer remained constant. For comparison, very recent data of emerging chiral pollutants such as the pharmaceutical ibuprofen and its main transformation products will be discussed. Enantioselective chromatography reveals very different transformation pathways in the human body, in the sewage treatment plant and in the river Elbe.

AGRO 328
Pesticide labeling issues for application efficiency

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Pesticide labels contain use directions to convey application efficiency instructions, use mitigations, and legal application rates. Directions for application efficiency are not always transparent and at times are confused with use mitigation and application rate information. The U.S. Environmental Protection Agency and product registrants craft and negotiate directions for use label language. There will be a discussion on the need to clarify the intent of some of the possibly misleading use direction language and how to better convey the underlying information to the pesticide applicator so they can achieve the greatest level of success with the product. The use of web-distributing labeling and corresponding web site hyperlinks may provide for better communication with pesticide applicators. These concepts will be presented.

AGRO 329
EPA's proposed guidance to improve drift labeling of pesticide products

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EPA has developed and issued for public comment draft guidance on pesticide drift labeling. The purpose is to provide guidance to registrants and applicants for registration on labeling statements concerning pesticide drift, and to inform the public of EPA's policies regarding mitigation of pesticide drift. The draft guidance proposes labeling statements and formats to improve communication of drift management requirements to pesticide applicators and as a result, to improve protection of people and other non-target organisms and sites from potential adverse effects that may be caused by off-target pesticide drift. The Agency believes the use of these statements and formats on labels will provide users consistent, understandable, and enforceable directions about how to protect human health and the environment from harm that might result from pesticide drift. EPA received a variety of comments on many aspects of the guidance which will be summarized in the presentation.

AGRO 330
Validation testing of drift reduction technology test protocol

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This paper provides an update of EPA's efforts to validate a test protocol to evaluate pesticide drift reduction technologies (DRTs) and discusses plans for using a validated protocol in a voluntary program to identify and encourage the use of DRTs to reduce spray drift. Working with a stakeholder technical panel, EPA developed the test protocol adapted from methods used in other countries. EPA's method will be used to generate high-quality, peer-reviewed data, including test design and quality assurance aspects. In validating the protocol, low-speed and high-speed wind tunnel tests were completed using a reference nozzle and two test nozzles to evaluate the performance of the generic protocol. Based on the results EPA will finalize the protocol and encourage manufacturers to voluntarily test their equipment. EPA may credit the use of verified DRTs in its risk and registration decisions and applicators for using the DRTs.

AGRO 331
Testing and validation of EPA protocols for the evaluation of drift reduction technologies (DRTs)

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The EPA developed protocols for assessing spray drift reduction technologies for agrochemical application. Presently, protocols for high- and low-speed wind tunnel and full-scale field studies are drafted. Testing and evaluation of both wind tunnel protocols are reported. Nozzles were evaluated for relative drift reductions compared to a reference, using dispersion modeling. Droplet sizes downwind of the nozzles were measured. Low-speed tunnel measurements included the downwind spray plume flux profile. Overall, high-speed tunnel testing data for aerial application technologies provided quick, repeatable measurements. Low-speed testing data collection was much more cumbersome and time consuming with less repeatability. Translation of measured data from high-speed data to downwind concentrations use established models of the entire spray system versus developed low-speed models for individual nozzles. Both protocols contain overly restrictive data quality requirements. The proposed program has great potential but requires additional development and validation prior to widespread usage.

AGRO 332
Management of pest control product drift using chemical methods: Current and future trends

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Pest control products that drift away from the target area and plants cause economic damage to the applicator/farmer and damage to non-target crops and the environment. There are two types of drift. Chemical drift is caused by a shift in equilibrium that encourages the formation of a volatile form of the pesticide. The pesticide, during spraying or after landing on the target, volatilizes then drifts to non-target areas. Physical drift is caused by the formation of small

droplets at the application nozzle. These small droplets then move by wind to non-target areas. Physical drift can be reduced but not eliminated. The extreme diversity of tank mix options requires that any drift control technology be tremendously flexible. Therefore, physical drift technologies are limited to a very few classes of compounds and systems. Current EPA efforts include means to quantify drift and the technologies used to control drift. These efforts will prove enormously difficult because of the variety of tank mix options.

AGRO 333
Overview of California drift management issues and drift reduction measures

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This presentation gives an overview of California drift management issues, specific regulatory actions and drift reduction measures. Drift is separated into two categories: 1) spray drift (primary drift) and 2) post application drift (secondary drift). The distinct issues associated with each category will be discussed. The California Department of Pesticide Regulation and the Country Agricultural Commissioners have distinct roles regarding drift, illustrated by the development and implementation of mitigation measures for each type of drift. Propanil and methyl bromide are both restricted requiring permits for each application and other specific regulatory requirements. Propanil is a commonly used rice herbicide that had been associated with non-target crop impacts due to spray drift. Methyl bromide is a soil fumigant that has known potential for post application drift even when applications are made according to label requirements. Mitigation measures developed to allow the continued use of both of these pesticides will be presented.

AGRO 334
Calculating spray drift buffers using FIFRA methodology

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When crop protection products are released using sprayer technologies, a small fraction of spray solution may move off target. In order to ensure the safety of areas surrounding target spray zones, physical buffers may be used to ensure spray material does not reach sensitive areas. The process followed to derive spray area buffers includes models to calculate safe distances to sensitive areas. Modeling approachs maybe the most practical way for determining buffer distances. Current FIFRA methodology was followed to derive physical buffer distances. Results from this examination indicate that buffer distances derived following current FIFRA methods are highly conservative, and refinements to current models are possible without risking sensitive areas.

AGRO 335
Thermal inversions frequency of occurence according to one Louisiana weather station

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Since 1999, the Louisiana Department of Agriculture logs an annual average of 47 drift complaints against aerial applicators and 29 against ground sprayers. Available records do not indicate size of the area affected or reason for the drift occurrence although experience suggests that many weather parameters are ignored by applicators and may be the reason for many drift complaints. The stability ratio (SR) equation proposed by Munn (1966) can be easily implemented as a calculated parameter in automated weather stations. Once available, applicators can check atmospheric stability conditions in real-time. To demonstrate to the Louisiana agricultural community the importance of frequent observation of weather parameters such as inversions and wind speed before spraying, 2008 data from one automated station was downloaded and used to calculate SR from March 1st to October 31st. Results will be used to educate operators and pilots on how to recogniz thermal inversions

AGRO 336
How can we improve honeybee risk assessment? ICPBR proposals

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While the current EU risk assessment scheme for honeybees is considered to be robust and effective, an ongoing process of review and appropriate development is undertaken by the International Commission for Plant-Bee Relationships Bee Protection Group. This group comprises representatives from academia, government and industry, including the beekeeping sector. A major part of the 10th Symposium of the ICPBR Bee Protection Group (October 2008 in Bucharest, Romania), which included over 80 delegates from 15 countries, considered proposed revisions of the European Plant Protection Organisation guideline 170 and the associated risk assessment scheme, which forms the basis of regulatory evaluations for the effects of pesticides on honey bees in the European Union. A gap in the current risk assessment portfolio is considered to be non-sprayed products such as soil treatments and seed dressings which may be expressed in pollen, nectar (including extra-floral nectaries) or aphid honeydew. In addition further guidance has been requested for higher tier test methodologies. The revision process was based on the work undertaken by three working groups addressing: (1) higher tier testing (cage and field trials); (2) the risk to bees from the use of plant protection products through seed coating and soil applications (systemic effects); (3) the risk to honey bee brood (including *in vitro* larval testing methodology). The work of these groups have been developed into the current proposals for the revised EPPO honeybee testing guidelines and risk assessment scheme which will be submitted to EPPO and to EFSA (European Food Safety Agency) for consideration as part of the revision of the Terrestrial Ecotoxicology Guidance Document started in early 2009. The issues around exposure assessment which are fundamental to both the systemic risk assessment scheme and in the design of appropriate semi-field and field trials, and the proposed solutions will be discussed in more detail.

AGRO 337
Chlorantraniliprole: Risk assessment for honeybees considering spray application and systemic exposure via soil dosing

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Effects of chlorantraniliprole (DPX-E2Y45, DuPont™ Rynaxypyr®) – a new anthranilic diamide insecticide with a novel and very specific mode of action activating insect ryanodine receptors – on pollinators (*Apis mellifera*, *Bombus terrestris*) were investigated. Acute toxicity tests with chlorantraniliprole and the formulated products, Coragen® and Altacor®, demonstrated low intrinsic toxicity to honeybees. Low risk for honeybees was confirmed in semi-field tunnel tests with Coragen® and flowering *Phacelia* or wheat. Low potential of systemic exposure via pollen and nectar of honeybees to chlorantraniliprole was documented in a semi-field tunnel trial with chlorantraniliprole applied to and mixed into bare soil. Bumblebees directly over-sprayed during foraging activity with Altacor® or exposed to treated tomato under commercial greenhouse conditions behaved as controls. Overall, chlorantraniliprole formulations provide excellent tools for integrated pest management (IPM) programmes to conserve important pollinators.

AGRO 338
High levels of miticides and systemic agrochemicals in North American beehives: Implications for honey bee health

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Recent declines in honey bees for crop pollination threaten US fruit, nut, vegetable and seed production. Using LC/MS-MS, GC/MS and a modified QuEChERS method, we found 121 different pesticides and metabolites within 887 wax, pollen, bee and associated hive samples. Almost 60% of pollen and wax samples, in contrast to 11% of bee samples, contained at least one of 43 systemic pesticides, 57% in combination with a pyrethroid. Over 47% of pollen and wax had both in-hive miticides fluvalinate and coumaphos combined with up to 99 ppm of chlorothalonil. This fungicide frequently co-occurred in pollen with systemic pesticides including aldicarb, imidacloprid, boscalid and myclobutanil. Almost all comb and foundation wax was contaminated with miticides and other pesticides, averaging 8 detections with a high of 39 per sample. Potential consequences to bee health of pesticide combinations in their food and comb, including pro-systemicides and their toxic degradates, will be discussed.

AGRO 339
Pesticide residues in pollen collected by foraging honey bees in Connecticut

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There are many potential threats to the honey bees including: poor nutrition, migratory stress, varroa mites, colony collapse disorder, and pesticides. Our research is focused on pesticides. Some pesticides are used by beekeepers to help control mites, while others can be acutely toxic or perhaps contribute to chromic toxicity due to long term low level exposure. However, there are only very few studies which are evaluating long term honey bee exposure to pesticides. We have therefore initiated a study to determine the typical background exposure of honey bees to pesticides by determining the pesticides concentrations in pollen collected by foraging honey bees. Hives representing urban, suburban and rural locations within Connecticut have been monitored for the past three years throughout the honey bee foraging season. These data allow us to examine spatial and temporal differences in pesticide loads. The samples are extracted using a modified version of the QuECHERs procedure (extraction with acetonitrile with solid phase dispersants) using an isotopically labeled internal standard. The concentrated extract is analyzed with HPLC/MS/MS. The results show that honey bees are exposed to a wide variety of pesticides, including pesticides applied within the hive to control mites, as well as those used in agricultural fields and residential landscaping. The pesticide exposure varies with both hive location and time of year, and can rapidly change depending on local pesticide usage.

AGRO 340
Trends vs. peaks: Interpreting data for toxic chemicals in bee colonies

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Reporting contaminant levels from honey bee colonies, as for any plants or animals surveyed for toxic chemicals, introduces issues related to interpretability and uncertainty in the data. Distribution of concentrations is often strongly skewed. When only a few samples exhibit high concentrations, mean values, even when accompanied by measures of error, may not convey sufficient information about the dispersion in the sample measurements. Without a more complete description of variation among samples and levels of uncertainty in the data, inference from reported chemical concentrations is difficult and prone to misinterpretation. Increasingly we see peak or maximum values presented as representative of levels of target compounds in biological samples, without any information on error or distribution of values within the data. Using our extensive data sets for toxic chemicals in honey bees and hive components, collected over the past 35 years, we illustrate how incomplete reporting can bias interpretation of results. We also illustrate how additional data can improve understanding and provide for more objective inferences from biological assays.

AGRO 341
Overview of methods used to sample pollen and nectar in exposure studies

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Honey bees provide an essential service for the pollination of many high value crops worldwide, as well as for many other crops and wild plants. However, this pollination service is being threatened by declines in honey bee health and colony losses as honey bees struggle to survive many new stressors in recent decades. Pesticides have been suggested as one of the factors that may be causing the decline of honey bee colonies. Studies to determine exposure and effects of pesticides to honey bees are becoming standard practice. Since honey bee colonies are complex societies of many interacting individuals that travel a minimum of several kilometers in all directions in search of resources, it is clear that exposure opportunities can be many. Any pesticide molecules present in the environment that are attached to, or incorporated into, pollen, nectar, water, and plant resins, may be collected by bees. This paper will review the methods used by the author for sampling pollen and nectar from foraging bees and plants, and how pollen, nectar/honey, and wax are collected at the hive.

AGRO 342
Field studies to assess exposure and risk of the honeybee to pesticides

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Abstract not available

AGRO 343
Appropriate sample materials and sampling techniques to determine the exposure level of honeybees to systemic residues in nectar and pollen of crop plants under typical agronomic conditions

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Abstract not available

AGRO 344
Occurrence, fate, and transport of emerging contaminants in the Sacramento-San Joaquin delta

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As the largest estuary on the Pacific coast, the Sacramento-San Joaquin Delta in California serves not only as a drinking water source for 25 million Californians, but also provides for millions of acres of irrigated farmland and serves as the receiving body to several wastewater treatment plants. The Delta's fragile ecosystem raises concern about water quality issues, including pharmaceuticals and other contaminants of emerging concern (CECs) from municipal and industrial wastewater discharge, and agricultural activities. A suite of CECs and agricultural chemicals were analyzed from sampling locations upstream and downstream of wastewater discharges, at an urban run-off site, and an agricultural drainage site. The most frequently detected analytes were carbamazepine (anti-convulsant), Diuron (herbicide), sulfamethoxazole (antibiotic), caffeine (stimulant), primidone (anti-convulsant), and tris(2-chloroethyl)phosphate (TCEP, flame retardant), at ng/L levels. In addition, some fate and transport data were evaluated.

AGRO 345
Sediment contamination and biological effects relationships in California's Sacramento and San Joaquin River Delta

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California's Sacramento and San Joaquin River Delta is the state's largest estuary system and receives runoff from intensive agricultural operations in the Central Valley. Little is known about sediment contamination in the tidal freshwater habitats of the Delta, and whether this contamination impacts benthic and aquatic communities in the region. We examined sediment contamination (including legacy and current use pesticides), toxicity, and benthic invertebrate community condition at 75 locations during 2007-08. Multiple agricultural chemicals were detected in sediments throughout the Delta, including diuron, pyrethroids, methoxychlor, and piperonyl butoxide. Concentrations were generally low and below thresholds of acute mortality, which was confirmed by toxicity tests using amphipods (*Hyalella azteca*) and midges (*Chironomus dilutus)*. Temporal and spatial patterns of Delta sediment contamination and relationships with sublethal toxicity and benthic community composition will be described.

AGRO 346
Estrogenic activity observed in the lower Napa and Sacramento Rivers: Influence of alkylphenol ethoxylate and pesticide mixtures

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To evaluate the occurrence and sources of compounds capable of feminizing fish in waterways of Central California, water samples were extracted and subjected to chemical analyses as well as *in vitro* and *in vivo* measurements of estrogenic activity using fish hepatocytes and whole animal bioassays, respectively. Among the 16 sites sampled, two locations frequently conferred elevated concentrations of estrogenic activity year-round. The measured concentrations of steroid hormones were well below levels needed to explain the observed biological activity in both bioassays. Following bioassay-guided fractionation, chemical analyses of bioactive fractions by GC/MS/MS, and LC/MS/MS of a broad suite (>100) of endocrine-disrupting compounds including the most common natural and synthetic sex steroids, phytoestrogens, human pharmaceuticals, personal care products and agricultural pesticides and alkylphenol-containing adjuvants only indicated the occurrence of several triazine herbicides, their degradates (0.5-7 ng/L), diruon (7 ng/L) and a mixture of aklyphenol ethoxylates (APEs) (2.4-156 ng/L). Bioassays were conducted on reconstituted water containing mixtures of the measured concentrations of the detected compounds and 5 fold higher (pesticides) or 10 fold

higher (APEs) concentrations. When hepatocytes or fish were exposed to a mixture of the pesticides at ambient concentrations or the 5X concentration, estrogenic activity was not observed. Likewise, when APE mixtures were evaluated, no response was observed at ambient or the 10X concentration. However, when cells and fish were exposed to ambient concentrations of pesticides and 10X higher concentration of the APE mixture, significant increases in estrogenic activity were observed. These data indicate elevated APE mixtures may enhance estrogenic activity of pesticides or other estrogenic substances in these waterways.

AGRO 347
Emerging marine antifoulant Irgarol 1051 in California marinas

Y. Sapozhnikova[1], yelena.sapozhnikova@noaa.gov, K. Schiff[2], N. Singhasemanon[3], E. Wirth[1], and M. Fulton[1]. [1]HML, CCEHBR, NCCOS, NOS, NOAA, Charleston, SC, United States, [2]Southern California Coastal Water Research Project, Costa Mesa, CA, United States, [3]California Department of Pesticide Regulation, Sacramento, CA, United States

Irgarol 1051 is a common antifouling booster biocide in copper-based paints. It is highly toxic to non-target plant species at low ng/L concentrations. Irgarol concentrations detected in San Diego area recreational marinas in 2005 were as high as 304 ng/L. In 2006, we reported Irgarol concentrations up to 712 ng/L in recreational marinas throughout Southern and Northern California. As part of the California Bight 2008 program, we measured up to 254 ng/L Irgarol concentrations in water and up to 9 ng/g dry weight Irgarol in sediments from Southern California recreational marinas. The maximum Irgarol concentrations detected in water in California marinas in 2005-2008 were greater than the Irgarol concentration recommended as the plant toxicity benchmark (136 ng/L), suggesting that detected Irgarol concentrations may be high enough to cause changes in phytoplankton communities in the sampled marinas. Irgarol accumulation in sediments may present a potential undetermined risk for benthic organisms.

AGRO 348
Watershed-scale effectiveness of agricultural best management practices (BMPs) for pesticides in three California estuaries

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Along California's Central Coast, the three largest watersheds drain to ecologically important coastal estuaries. Each of these watersheds contains intensively cultivated agricultural land. Farm groups are initiating BMPs to control pesticide runoff, but there has been no designated effort to document the cumulative loading and effects of pesticides in these coastal estuaries. This study is designed to provide a baseline assessment to support future evaluations of the watershed-wide effectiveness of BMP implementation. The Pajaro, Salinas, and Santa Maria River estuaries were monitored over a two-year period to measure contaminant concentrations and effects in estuarine water, sediment, and biota, and to link contaminant profiles with those from the main rivers and adjacent tributaries. Biological measurements at the molecular, organismal, and community levels were measured synoptically to determine associations with contaminants. Toxicity to invertebrates demonstrates spatial and temporal variability in these watersheds, and occurred at stations with elevated concentrations of current-use pesticides.

AGRO 349
Occurrence and potential impacts of current-use pesticides in a central California coastal ecosystem

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The central coast of California is a region with high pesticide use due to intensive agriculture and rapid urban growth. The Santa Maria River/Estuary contains elevated concentrations of current-use pesticides and exhibits water and/or sediment toxicity intermittently throughout the year. A study to assess the occurrence and toxic effects of current-use pesticides on invertebrates and fish in coastal ecosystems is ongoing. Elevated concentrations of organophosphate and pyrethroid insecticides were detected in both water and sediment throughout the year and have contributed to the majority of the macroinvertebrate toxicity. Three fungicides (axozystrobin, boscalid, and pyraclostrobin) were detected at relatively high concentrations in both water (>1 ppb) and sediments (> 20 ppb) but their aquatic toxicity is currently unknown. Ongoing work will measure the accumulation of current-use pesticides in invertebrates and fish in an attempt to better understand the fate and effects of pesticides on aquatic organisms in coastal areas.

AGRO 350
Endocrine disruption in a California estuary: Individual- and population-level effects in a resident fish species

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Endocrine disrupting compounds (EDCs) are widespread in the environment and known to impact fish reproduction. A large body of work exists on EDC effects in laboratory species; however, fewer studies have considered resident fish. We use *Menidia beryllina*, a ubiquitous euryhaline fish, as an indicator of EDCs in Suisun Marsh, in which a wide range of contaminants, including emerging EDCs (pyrethroids), are present. Our investigation is three-tiered. First, solid-phase extracts from areas exposed to treated wastewater, urban or ranch run-off produce significant evidence of binding to the nuclear estrogen and androgen receptor in receptor-transfected cell lines. Secondly, immunoanalyses reveal that wild males express choriogenin (egg shell protein); outplanting and bioassays indicate choriogenin levels in marsh-exposed and pyrethroid-exposed fish are greater than controls. Lastly, sites exposed to different EDCs exhibited significantly different sex ratios throughout 2009. These results suggest that individual-level effects may scale up to population-level consequences.

AGRO 351
Stereoselective metabolism of 1,2,4-triazole fungicides in hepatic microsomes and implications for risk assessment

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The 1,2,4-triazole fungicides (i.e., conazoles) are potent cytochrome P450 (CYP) modulators and have been used extensively in agriculture and medicine. Recently, emphasis

has been placed on the potential adverse effects of these compounds on mammalian steroid biosynthesis and endocrine system disruption; some conazoles have also been linked to tumor formation in rodents. Although nearly all the conazole fungicides are chiral, and in some cases formulated as specific mixtures of diastereomers, relativeliy little is known about the environmental fate, metabolism and toxicity of individual diastereomers and enantiomers. We have utilized in vitro metabolism assays in conjunction with enzyme kinetics, human CYPs, and molecular modeling to eludicate the mechanisms and kinetics of stereoselective and stereospecific conazole metabolism in vertebrate and invertebrate species, including humans. Results will be presented that illustrate the use of these techniques for studying xenobiotic transformations in biological systems and how experimental results are used to improve risk assessment.

AGRO 352
Stereoselective behavior of chiral pesticides in the environment

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The stereoselective behavior of chiral pesticides in the environment was investigated by high performance liquid chromatography (HPLC) with cellulose tris-(3,5-dimethylphenyl-carbamate) as the chiral stationary phase. The enantioselective pharmacokinetics and metabolism of theta-cypermethrin, hexaconazole, tebuconazole, ethofumesate, metalaxyl, lactofen, and benalaxyl in rabbits and rats by intravenous injection and the stereoselective degradation of benalaxyl, fipronil, diclofop-methyl, lactofen, fenoxaprop-ethyl and ethofumesate enantiomers in soil, water and crops were studied. We also investigated the enrichment and metabolism of pesticide enantiomers in earthworm and assessed the stereoselective remediation of chiral pesticide pollution. The results showed that most of the selected chiral pesticides were enantioselectively degraded in the environment, including soil, plant and animals. These studies will make important contributions to the risk assessment of chiral pesticide contamination.

AGRO 353
Enantioselectivity in effects of metolachlor on Cyt 450 enzyme systems in maize and rice

H. Liu[1], lhj@mail.zjgsu.edu.cn, M. Xiong[2], and W. Cai[1]. [1]Zhejiang Gongshang University, College of Environmental Science and Engineering, Hangzhou, Zhejiang, China, [2]Zhejiang University, College of Environmental and Resource Sciences, Hangzhou, Zhejiang, China

The content and spectral characteristics of cytochrome P450 (Cyt P450) induced by *rac*- and *S*-metolachlor extracted from shoots of etiolated maize and rice seedlings were studied. The effects of *rac*- and *S*-metolachlor on activities of CYP1A1-associated ethoxyresorufin O-deethylase (EROD) and CYP2E1-associated 4-nitrophenol hydroxylase (4-NPH) were also measured. The content of maize and rice microsomal Cyt P450 induced by *rac*-metolachlor was higher than that induced by *S*-metolachlor with $p<0.05$. When induced by *rac*- and *S*-metolachlor, the maize Cyt P450 content was, respectively, 3.02- and 2.48-fold that of the control, while the rice Cyt P450 content was 1.91- and 1.33-fold that of the control. The EROD and 4-NPH activities induced by *S*-metolachlor were higher than that of rac-metolachlor. The interaction of microsomal Cyt P450 with *S*-metolachlor was higher than that with *rac*-metolachlor, which may be one of the reasons why *S*-metolachlor is superior at killing weeds compared with *rac*-metolachlor. These results will help to develop a better understanding of the tolerance for and selectivity of *rac*- and *S*-metolachlor.

AGRO 354
Enantioselectivity in biodegradation of current-use chiral insecticides

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Chiral selectivity during biodegradation of chiral pesticides results in different compositions of enantiomers in the environment and likely different adverse effects on non-target organisms. Over the last few years, we evaluated the occurrence of chiral selectivity in the microbial degradation of a range of current-use insecticides including many pyrethroids, some organophosphate compounds, and fipronil, in soils and sediments. Clear selectivity was observed under some experimental conditions, including in field samples. Laboratory experiments were carried out to test the selectivity under controlled conditions. Chiral selectivity was seen in some cases but not in the others. We further observed abiotic isomerization of enantiomers in some polar solvents for some chiral compounds. This presentation will provide an overview of these and other published studies and discuss patterns in enantioselective degradation of chiral pesticides in the environment.

AGRO 355
Enantioselective phytotoxicity of imazethapyr in A*rabidopsis thaliana* and rice

H. Qian, hfqian@zjut.edu.cn, H. Hu, W. Liu, and **Z. Fu**, azwfu2003@yahoo.com.cn. College of Biological and Environmental Engineering, Zhejiang University of Technology, Hangzhou, Zhejiang, China
The enantiomers of a chiral pesticide have identical physical-chemical properties, but may exhibit dramatically different biological properties. In the seedling morphological assay, imazethapyr (IM) enantiomers inhibited elongation of primary roots and shoot of *Arabidopsis thaliana* in a dose-dependent manner. When exposed to 2.5 mg L^{-1} *R*-(-)-IM, *S*-(+)-IM and racemate for 15d, the root relative inhibition rates reached 79.1%, 43.3%, and 46.0%, and the shoot relative inhibition rates were 57.0%, 41.5%, and 40.0%, respectively. These results proved that *R*-(-)-IM inhibited root and shoot development stronger than *S*-(+)-IM, being consistent with our previous results in rice. The results also showed that *R*-(-)-IM inhibited ALS activities in vitro stronger than *S*-(+)-IM both in *Arabidopsis thaliana* and rice. Survival rate of rice protoplast were 46.0%, 82.0% and 68.0% after 24 h-exposure to 20 mg L^{-1} *R*-(-)-IM, *S*-(+)-IM and racemate. Results from this study imply that *R*-(-)-IM has stronger toxicity than *S*-(+)-IM on the growth of monocotyledon and dicotyledon.

AGRO 356
Enantioselective synthesis and antiviral bioactivities of novel chiral β-amino acids ester derivatives

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The synthesis of optically pure enantiomer of β-amino acids and their esters derivatives with desired property constitutes an important task in chiral drugs synthesis. In continuation of our research program of antiviral agent, we designed and synthesized a series of novel chiral β-benzothiazoleyl- β -amino acids esters which can be prepared from malonates induced by chiral organocatalyst e.g. bifunctional cicnchona alkaloid and N-substituent-benzothiazole-yl imines in 80–95% yields with excellent enantioselectivites (90%–99% ee)

under mild conditions. The studied chiral compounds displayed good in vivo curative, protection and inactivation effects. The role of stereochemistry of chiral compounds on antiviral activity was also studies. The proposed mode of action of the new chiral compounds against TMV and CMV will be presented. To the best of our knowledge, this is the first report on the synthesis and antiviral activity of the chiral title compounds.

AGRO 357
Chirality in agrochemicals: A burning issue

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Generally, one of the enantiomers of a racemic agrochemical is more carcinogenic/toxic than its antipode. Therefore, data available on the carcinogenesis of the racemic mixture of the chiral pollutant is not reliable and needs modification in terms of any enantioselective carcinogenicity. It is essential to explore the enantioselective carcinogenesis due to different toxicities of chiral pollutants. Knowledge of the stereoselective metabolism of the chiral pollutant may be useful for cancer treatment . The enantioselective carcinogenicity/toxicity due to chiral pesticides, polynuclear aromatic hydrocarbons, and other xenobiotics will be discussed.

AGRO 358
Drift reduction technologies in Australia and New Zealand

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Australia and New Zealand have recently implemented plans to encourage the use of drift reduction technologies. Research into the development and validation of these technologies is based on studies in wind tunnels as well as field trials. This paper reports on technologies including adjuvants designed to work with specific nozzle types, barrier vegetation designs optimised for drift interception without displacement over the vegetation top, and retrofit devices for aerial and ground sprayers.

AGRO 359
Regulatory and technological approaches to drift reduction in the European Union

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The European Union (EU) Directive on machinery includes several standards for new equipment being placed on the market. One of the standards is on machinery for pesticide application. It addresses environmental concerns associated with pesticides. The recent EU Framework Directive on sustainable use of pesticides gives preference to use of low-drift equipment and obligates the Member States (MS) to protect the aquatic environment and drinking water from the impact of pesticides by using mitigation measures which minimize the risk of spray drift. These shall include the establishment of buffer zones for the surface water and other sensitive objects. Some MS have already implemented regulations on buffer zones and set the rules allowing the pesticide users to reduce the size of the zones provided they mitigate spray drift. Technical solutions such as shielded and selective applications, low-drift nozzles or adjustable air assistance are promoted to reduce drift.

AGRO 360
Improving spray drift management through applicator education and equipment calibration

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The Coalition for Urban Rural Environmental Stewardship (CURES) has undertaken numerous projects on operator training, spray equipment calibration and applicator practices to minimize pesticide spray drift. CURES assessed 75 orchard sprayers in Sacramento Valley using a state-of-the-art sprayer calibration system. Before and after measurements showed that proper calibrations, replacing nozzles, cleaning filters and other system adjustments improved overall orchard sprayer efficiency an average of 8%. Spray drift practices were discussed with operators at on-farm clinics. CURES performed a study on effectiveness of spraying inward only along the orchard perimeter to minimize pesticide ground deposition. In multiple presentations to growers and Pest Control Advisors, CURES stresses monitoring wind speed direction, allowing for adequate buffers from sensitive areas and proper droplet size as stewardship practices for managing pesticide drift. Also the practice of not spraying outward on the outer two rows. Many CURES publications cover spray drift and are at http://www.curesworks.org/publications/ag.asp.

AGRO 361
Best management practices for boom sprayers: What is in this new international standard and how can we put it to use?

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Pesticides need to be applied accurately and uniformly. Too little pesticide results in poor pest control and reduced yields, while too much injures the crop, wastes chemicals and money, and increases risk to the environment. A new international standard developed by the American Society of Agricultural and Biological Engineers (ASABE; Standard S592) gives a list of general recommendations, or steps to follow, to help pesticide applicators achieve greater accuracy and efficiency in liquid pesticide application using boom-type ground sprayers. This paper will give a summary of the content of this Standard, and will outline how various groups of users (pesticide applicators, educators, agrochemical manufacturers) may utilize this standard to achive a higher efficiency in pesticide application, a higher efficacy from pesticides, and improve safety of operators.

AGRO 362
Use of imidacloprid in California for the management of Asian Citrus Psyllid

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Abstract not available

AGRO 363
Methods to assess pollinator exposure to imidacloprid treated hardwood trees as part of the USDA-APHIS Asian Longhorned Beetle control program

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The USDA-APHIS Asian Longhorned Beetle control program uses imidacloprid as a soil or truck injection treatment in several hardwood species. Some of these tree species are visited by honey bees for nectar and pollen and thus potential exposure to imidacloprid may occur as treated trees bloom. We devised a sampling scheme to evaluate the risk to honey bees of imidacloprid exposure in pollen and nectar from selected hardwoods. Our main focal tree is red maple as it is widely distributed in both the New York and Massachusetts treatment areas and is a major pollen and nectar source for bees in the early spring. In both states we collect flowers, leaf samples and foraging bees on red maple. The health measurements and details of the experimental plot layouts will be discussed in detail along with some preliminary results from a pretreatment year in MA and first year data from NY.

AGRO 364
Pros and cons of methods used to sample honey bee hives for analysis of pesticides and other contaminants

J. J. Bromenshenk[1,2], beeresearch@aol.com, and C. B. Henderson[1], colin.henderson@umontana.edu. [1]University of Montana, Missoula, MT, United States, [2]Bee Alert Technology, Inc., Missoula, MT, United States

Foraging honey bees make hundreds of thousands of forays per day, returning contaminants to the hive from vegetation, air, soil, and water from environs extending two or more kilometers away. These contaminants are accumulated from all three phases--gaseous, liquid, and solid—and include all categories of environmental pollutants. Of particular interest are pesticides and other agricultural chemicals. Many of these chemicals pose potential risks to animals other than bees, even humans who consume hive products. Residue analysis offers a means of quantifying whole body and hive component contaminant concentrations in order to estimate exposure dose. However, identifying appropriate measurement endpoints and sampling methods is complicated and must consider the intended risk assessment endpoint (e.g., adult bees, brood, colony reproduction, other animals, and humans), sample heterogeneity, seasonality, location, weather, and other factors. Representative sampling is a worthy, but often unachievable expectation, as is selection of a single inclusive measurement end point. While some materials simply bioaccumulate, others bioconcentrate in bees and wax, or even biomagnify in hive pests and predators. Routes of entry are many and complex, and exposure to chemical particulates from soil dusts is seldom considered. Based on 35 years of sampling of bee colonies, we propose sampling recommendations and guidelines for appropriate sampling that will yield estimates of measurement uncertainty. Case studies from that research illustrate the pros and cons of various sampling methods and the uncertainties that affect reliable interpretation of the measurements.

Chemistry for and from Agriculture

AUTHOR INDEX

AGRO Scrapbook

Don R. Baker, 76, a retired Stauffer Chemical agricultural chemist, died on April 24. Born in Salt Lake City, Baker received an A.B. from Sacramento State College in 1955 and a Ph.D. in chemistry from the University of California, Berkeley, in 1959.

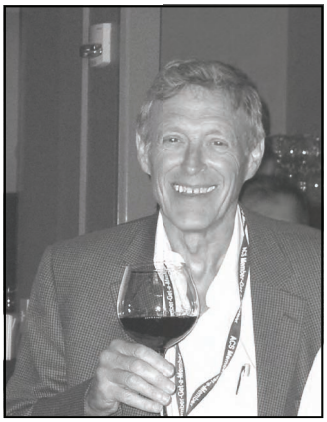
Baker established a long and distinguished career as a chemist, team leader, and senior scientist for Stauffer (now part of Syngenta), in Richmond, California. He retired in 1997 but continued working as a consultant. During his career, he was awarded 205 U.S. patents.

He was an emeritus member of ACS, joining in 1958. Baker was chair of the society's California Section in 1973, and he served as its councilor from 1971 to 2006 and as its director from 1999 to 2001. He was also active in the ACS Committee on Professional & Member Relations. He received the California Section's Walter B. Petersen Award for service in 1991.

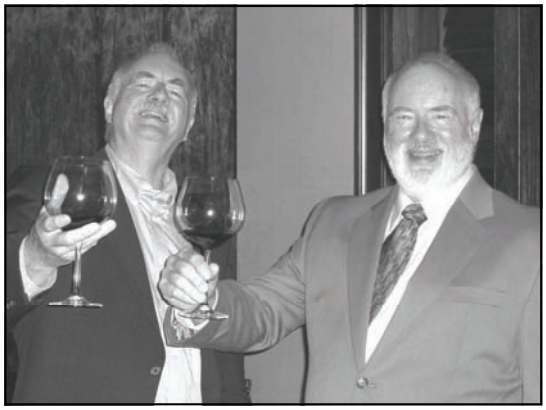
Baker enjoyed many hobbies including rock collecting, genealogy, raising orchids, and traveling. For nearly 30 years, he volunteered at the Family History Center of the Church of Jesus Christ of Latter Day Saints, in Oakland, California.

He is survived by children, Robert, David, and Barbara; stepchildren, Julie Pike, Wendy Katchmar, Heidi Howell, Emilie Eskelson, and Becky Forsyth; 25 grandchildren; and three great-grandchildren. His wife, Shirley, whom he married in 1953, predeceased him. His second wife, Shirlee, whom he married in 1994, died in August 2008.

C&E News, May 11, 2009, 87(19):36



AGRO Scrapbook



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Submit ad copy via email to:

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USDA-ARS
10300 Baltimore Ave.
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Beltsville, MD 20705
301-504-6298
laura.mcconnell@ars.usda.gov

WELCOME TO AGRO

Chemistry for and from Agriculture

AGRO is a division of the American Chemical Society. Its purpose is to promote knowledge benefiting society through advancements in agricultural public health, and environmental science and technologies.

AGRO DIVISION MEMBERSHIP APPLICATION

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- ☐ ***ACS member*** $12 (add AGRO membership to existing ACS membership)
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Division Membership Questions?

Contact: Dan Stout, US EPA, 919-541-5767, stout.dan@epa.gov

Notes

AGRO DIVISION
Sponsorship Opportunities

Diamond
$6,000 – 15,000

General Sponsor

- Company Logo listed in Inside Cover of PICOGRAM as Patron
- 1 Full page ad in PICOGRAM
- Logo on website sponsor page
- 5 AGRO memberships

Social Hour Sponsor – AGRO social hour held Tuesday evening at the National Meeting from ca. 6 – 8PM and is open to all members and guests

- Company Logo listed in Inside Cover of PICOGRAM as Patron
- Full page ad opposite Social Hour Announcement in PICOGRAM
- Signage and Sponsor Table at Social Hour
- Acknowledgement at Social Hour
- Logo on website sponsor page
- 5 AGRO memberships

Platinum
$3000 - <6000

General Sponsor

- Company Logo listed in Inside Cover of PICOGRAM as Patron
- 1 Full page ad in PICOGRAM
- Logo on website sponsor page
- 5 AGRO memberships

Award Sponsor – AGRO has several major awards presented at the National meeting for Senior and Younger Scientists

- Company Logo listed in Inside Cover of PICOGRAM as Patron
- Company name listed within the PICOGRAM on Award page and nomination form and within the Technical program
- Logo on website sponsor page
- Option to place sponsor table within award symposium room
- Acknowledged at Award presentation
- 5 AGRO memberships

Gold
$1,000 – <3,000

General Sponsor

- Company Logo listed in Inside Cover of PICOGRAM as Patron
- 1 Half page ad in PICOGRAM
- Logo on website sponsor page
- 2 AGRO memberships

Symposium Sponsor – AGRO has a variety of symposia at the National meetings falling into our standing topic areas. *Each half-day session is at least $1000.*

- Company Logo listed in Inside Cover of PICOGRAM
- Company Name listed within the Technical program with symposium
- Logo on website sponsor page
- Option to place sponsor table within award symposium room signage at refreshments

Silver
$300 – <1,000

General Sponsor

- Listed on website sponsor page
- 1 AGRO membership

PICOGRAM Sponsor – The PICOGRAM is mailed to each AGRO member and contains information on AGRO activities, programming, and awards along with the Technical Program and Abstracts. *Ad cost is $400 – 500.*

- Full-page ad in PICOGRAM

Bronze
$50 - <300

Coffee Hour Sponsor – Coffee breaks are provided during the technical sessions at the National Meetings

- Signage at the Coffee Breaks
- Listed on website sponsor page
- Listed on Hospitality Committee page of the PICOGRAM

PICOGRAM Sponsor – The PICOGRAM is mailed to each AGRO member and contains information on AGRO activities, programming, and awards along with the Technical Program and Abstracts. *Ad cost is $200 – 250.*

- Half-page ad in PICOGRAM

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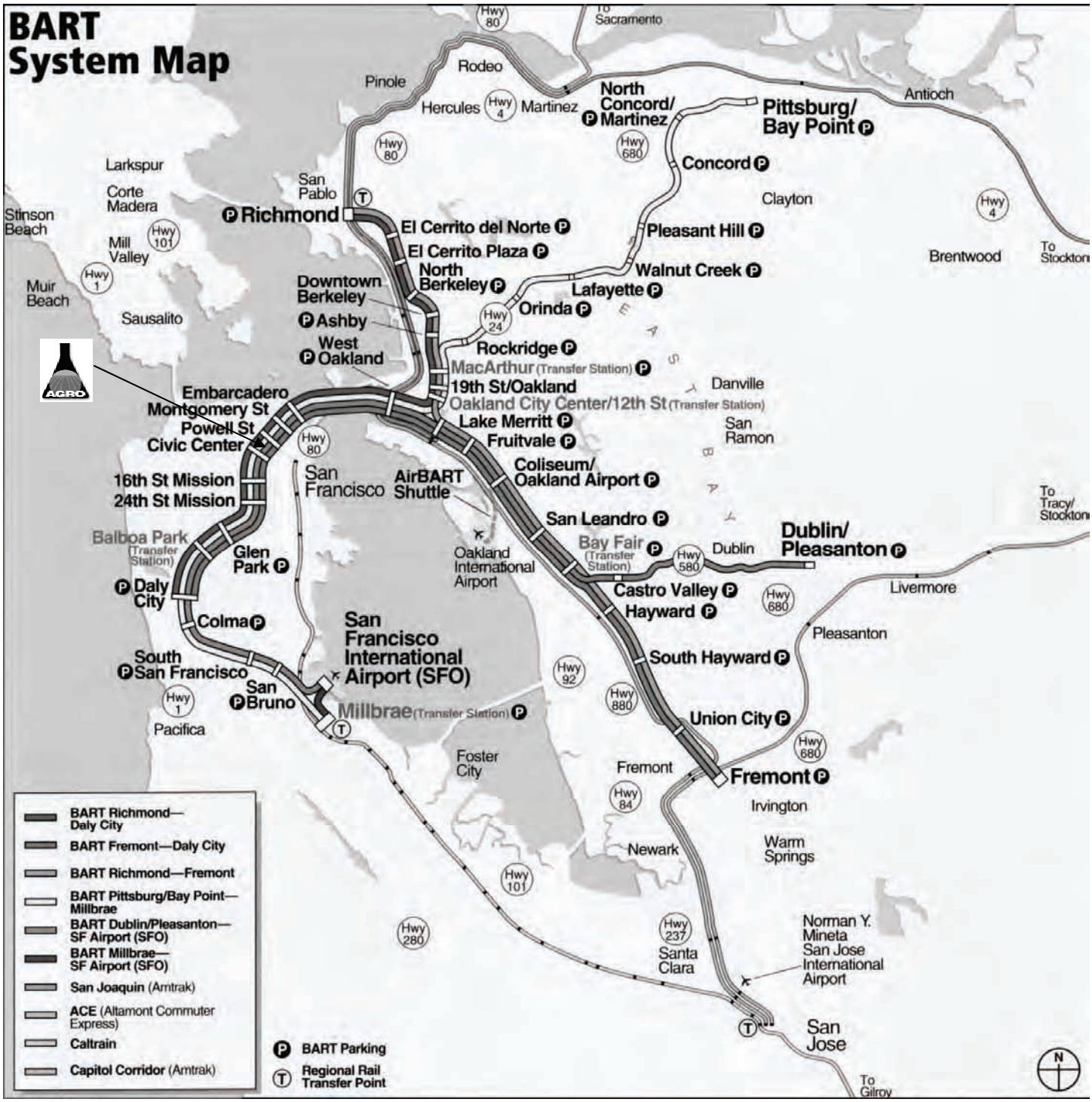


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HASTINGS LAW COLLEGE
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OPERA HOUSE
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AGRO

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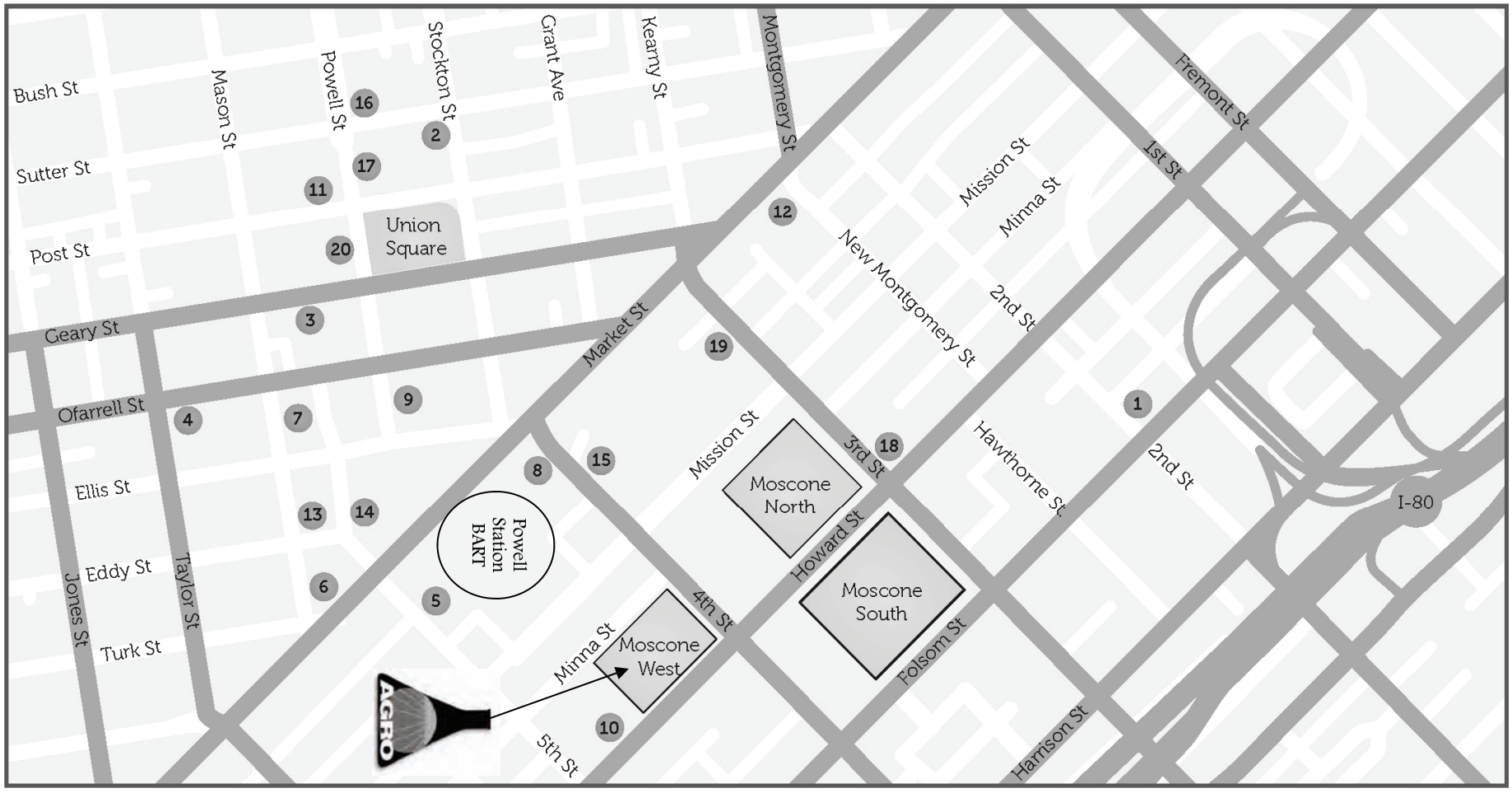
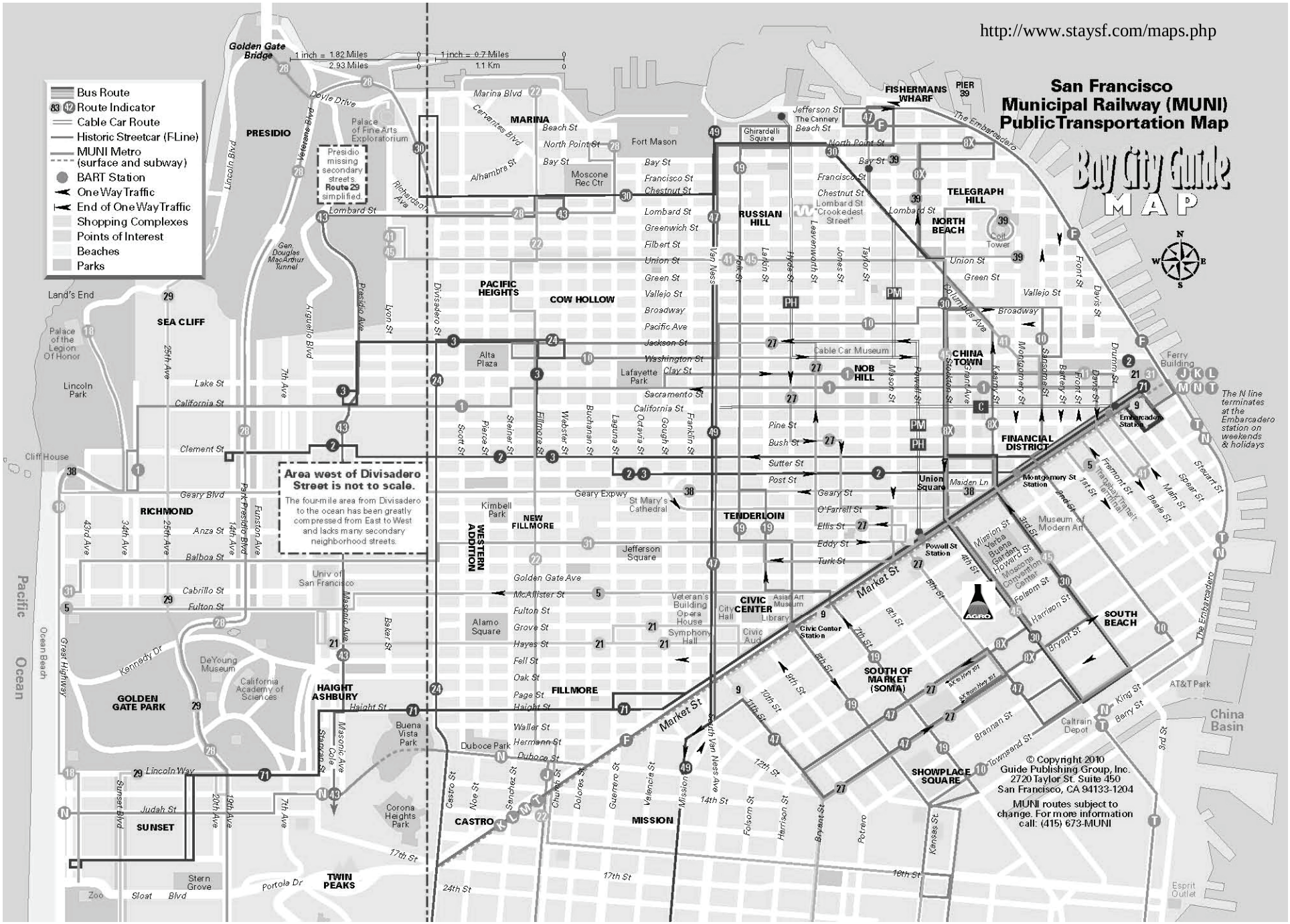
	Blocks from Moscone
1-Courtyard Marriott San Francisco Downtown	3.5
2-Grand Hyatt	5
3-Handlery Union Square Hotel	4
4-Hilton San Francisco Union Square	5
5-Hotel Milano	2
6-Hotel Metropolis	3
7-Hotel Nikko	4
8-Hotel Palomar	1
9-Hotel Union Square	3
10-InterContinental San Francisco	1

	Blocks from Moscone
11-Kensington Park Hotel	6
12-Palace Hotel	3.5
13-Parc 55	3
14-Powell Hotel	2.5
15-San Francisco Marriott Marquis	1
16-San Francisco Marriott Union Square	6
17-Sir Francis Drake	6
18-W	1
19-Westin San Francisco Market Street	2
20-Westin St. Francis	5

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PublicTransportation Map
Bay City Guide
MAP
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Route Indicator
Cable Car Route
Historic Streetcar (F-Line)
MUNI Metro (surface and subway)
BART Station
One Way Traffic
End of One Way Traffic
Shopping Complexes
Points of Interest
Beaches
Parks
Golden Gate Bridge
1 inch = 1.82 Miles
2.93 Miles
1 inch = 0.7 Miles
1.1 Km
PRESIDIO
MARINA
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PIER 39
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NORTH BEACH
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and Abstracts

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