PICOGRAM
And Abstracts

AMERICAN CHEMICAL SOCIETY

232st National Meeting & Exposition

September 10 – 14, San Francisco, California

Division of Agrochemicals

Fall 2006

Issue No. 71

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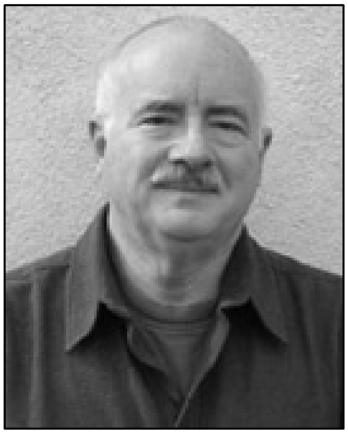
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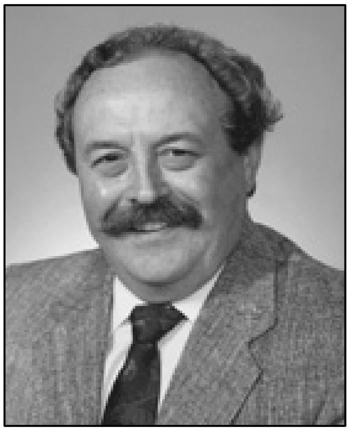
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HOSPITALITY COMMITTEE REPORT

COFFEE LOUNGE – ATLANTA, GEORGIA

Twelve generous companies contributed $2600 to give us coffee in our technical sessions in Atlanta. We thank them for their kindness and in return provide display space for their companies in the hospitality desk area. Please consider encouraging your company to become a sponsor also. Among AGRO's many fine distinctions has always been that we provide coffee for the attendees of our programs. It lends a touch of civility in a hectic and cruel world.

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THE SOCIAL HOUR – ATLANTA, GEORGIA

Jeff Jenkins toiled for months that we might have a splendid joint Social with the Agricultural and Food Division in the WESTIN Peachtree, Tuesday evening at 6:00PM. Members, speakers, and spouses all gathered in Vining I for assorted and sordid social entertainments with friends of many vintages. We had countless requests concerning our traditional Door Prize Drawing, but we did it again anyway.

COFFEE LOUNGE CO-CHAIRS – Liliana Schwartz & Terry Spittler
SOCIAL CO-CHAIRS – Al Barefoot & Jeff Jenkins

You Are Cordially Invited To

The Division of Agrochemicals

SOCIAL HOUR

When: *Tuesday evening, September 12, 6:00 – 8:00 pm*

Where: *The Club Room at the San Francisco Marriott*

ALL AGRO DIVISION MEMBERS, SPEAKERS, GUESTS, SPOUSES,
AND INTERESTED PARTIES ARE INVITED TO JOIN US

Open Meeting for All AGRO Members

Future AGRO Programming
and
Symposium Organizer Information

Wednesday, September 13, 5:00 – 6:00 pm
Marriott, Salons 4/5

Hosted by
Laura L. McConnell and John J. Johnston

- Come and share your ideas about the future direction of AGRO programming
- Learn more about organizing a symposium
- Let us know what topics are the most important to you

Refreshments will be served

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MESSAGE FROM THE CHAIR

Don Wauchope, AGRO Chair 2006

Ladies and Gentlemen:

Things are a-poppin'! A BIG meeting is coming up in San Francisco and we are very excited by this excellent turn out of submitted and solicited papers. The program for the Division of Agrochemicals will be one of the largest we have had in years! In addition, major changes in are happening to our *modus operandi*. The comments below are mainly to report to you the results of the historic AGRO Division meeting in Atlanta. THANKS TO AL BAREFOOT FOR HIS EXCELLENT MINUTES FROM THE MEETING which can be found on pages 50 – 53.

In Atlanta, we held the Governance Meetings sequentially. *We will do it the same way at San Francisco*. First was the Long Range Planning Committee meeting and followed by the Program Committee meeting. The results of those meetings plus all the Committee Reports were presented at the Executive Committee meeting.

A number of major initiatives came out of those meetings and many were approved.

1. ***Trial period of only one official AGRO meeting a year (Proposed at the Long Range Planning Meeting (LRPM) see PICOGRAM 2006, 70:10-11).***

   The actual motion is as follows: "Beginning in 2008 and through 2010, schedule Agrochemicals Division meetings and programming at the Fall ACS National Meeting only. Schedule special programming, co-sponsor meetings with related societies, or participate in ACS regional and local meetings during the 3-year trial."

   There were 12 Executive Committee (EC) members present and this proposal was warmly debated. The final vote was 8 yea and 4 nay, with an agreement for the Chair to poll the EC Members not present by email. I have polled 15 people who were current, incoming, or outgoing members of the EC. I heard back from 9 of them; all 9 voted 'Yea." So, I declare that this motion has been APPROVED and now we need to start thinking creatively about what activity we should be doing instead of the Spring 2008 meeting.

   You see, this is not just a travel-saving move. We want to use the intellectual and professional resources saved to not only create a stronger single National meeting each year, but also to create and support other smaller, more intensive and specialized conferences elsewhere in the year. Start visualizing: could some of our symposia be done better in a smaller, more focused meeting? Are there training and technology-transfer workshops we could put on which are needed? I believe ACS recognizes that smaller meetings have real advantages and they have expressed willingness to put their meeting organization expertise to work for us.

2. ***Grant one International Award each year (LRPM proposal)***

   Al Barefoot and Scott Jackson, who represent the sponsors of the International Awards DuPont and BASF, respectively, proposed granting a single International Award each year. The two companies would cosponsor the award, increase the honorarium to $5000, and pay travel expenses of $2000. Each company will contribute half the total cost ($3500) to support the award. BASF and DuPont have agreed in principle. The proposal was APPROVED unanimously.


United Kingdom
Switzerland
United States

MESSAGE FROM THE CHAIR
(continued)

3. ***Rename the Division (LRPM proposal)***

   There appears to be almost universal agreement that out current name is inadequate to describe the breadth of research we bring to meetings. We all know that names are such important carriers of identity that any proposed change will be strongly debated. We have started by asking Allan Felsot, that innovative former Chair, to poll the membership on this issue and we will appoint a Committee to begin the process at San Francisco.

4. ***International Activities Committee (LRPM proposal)***

   Jason Sandahl of the USDA – Foreign Agricultural Service (FAS) has been working actively to bring together the agricultural technology transfer needs of FAS and the expertise and programs of AGRO. This is turning out to be a dynamite connection and the committee's formation was proposed, APPROVED, and Jason was named Chair. There have already been big dividends from this. You will hear more in San Francisco!

5. ***Reorganization of AGRO Program Committee (Program Committee proposal)***

   An extensive and innovative proposal for revitalizing the Program Committee and helping it meet its function of providing exciting programs at the National Meeting *and* for looking far ahead to stay ahead of trends in science. The proposal was APPROVED unanimously. A special session will be held in San Francisco on Wednesday, September 13, in the Marriott, Salons 4/5, to develop this plan further (see pages 5, 32 – 34).

6. ***AGRO Participation in FAO/IAEA INFOCRIS web site (LRPM proposal)***

   This is an information site including pesticides that is one of those interesting "wiki" experiments. This proposal was APPROVED. Volunteers are needed to support and validate info for individual pesticides, and we are working on getting AGRO global publicity in exchange for participation by our members. Contact Mark Ogzewalla or Peter Ampin.

TERRY SPITTLER BECOMES AN AGRO FELLOW

Although there is much else to tell, I am running out of space and I want to end up with an item which makes me particularly happy. AGRO Treasurer Terry Spittler was awarded the AGRO Fellow Award in Atlanta for distinguished service to the Division. Terry has been doing this for *decades* and strives mightily to balance the budget and keep liberal spendthrifts' hands out of the till, but approach him with any idea that advances the cause of AGRO (and is carefully budgeted) and he not only gets on board but facilitates things any way he can. He is a pleasure to work with and has earned this award several times over.

Our warmest congratulations, Terry!

Hope to see YOU in San Francisco. It will be such a gas!

Don

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Contact:
Dr. Thomas Class
E-mail: Thomas.Class@ptrl-europe.de
Website: www.ptrl-europe.de

Internet Home Page: www.ptrlwest.com

Good science, no surprises.

AWARDS COMMITTEE REPORT

Dr. Isamu Yamaguchi, Plant Sciences Center, Riken (Japan) will receive the International Award for Research in Agrochemicals at the Fall 2006 ACS meeting to be held in San Francisco, California for his research in the chemistry of pest management, particularly the biochemistry of fungicidal action. John Clark, Nancy Ragsdale, and Fumio Matsumura will organize the award symposium in Dr. Yamaguchi's honor. This award will be sponsored by BASF Corporation.

Dr. Stanley Prusiner, M.D., Professor of Neurology and Director, Institute for Neurodegenerative Diseases, University of California, San Francisco will receive the USDA-ARS Sterling Hendricks Award for his work on prions and transmissible spongiform encephelopathies at the Fall 2006 ACS Meeting. The Agricultural and Food Chemistry Division of ACS will organize the award address, a reception, and a symposium in connection with this award.

Dr. Gerald T. Brooks, West Sussix, UK, Editor, Pest Science Management, will receive the International Award for Research in Agrochemicals at the Spring 2007 ACS Meeting in Chicago, IL for his research contributions in the study of the biochemical toxicology of insecticides. This award will be sponsored by BASF Company. An award symposium will be organized by Dr. Derick W. Gammon.

Dr. Frederick J. Perlak, Monsanto Company, St. Louis, MO will receive the International Award for Research in Agrochemicals at the Fall 2007 ACS Meeting in Boston, MA for his research contributions that led to the development of insect protected crops. This award will be sponsored by DuPont Crop Protection. Dr. William P. Ridley will organize the award symposium.

Nominations for the 2008 International Award for Research in Agrochemicals are currently being solicited by the Awards Committee. Only one International Award will be presented in 2008. The Awards Committee is also accepting new award nominations for the Division Fellow Award. The nomination forms for both are found in the PICOGRAM on pages 25 and 23, respectively. Please consider nominating a deserving colleague. The deadlines each year are December 31 for the International Award and May 31 for the Fellow Award.

USDA-ARS is seeking nominations for the 2007 Sterling B. Hendricks award. Deadline for nominations is November 6, 2206. Additional information can be found on page 27.

Congratulations to Drs. Yamaguchi, Prusiner, Brooks, and Perlak.

Respectfully submitted,

Jim Seiber

James N. Seiber, Chair
Awards Committee

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Worker Exposure
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Fumigant Residue Analysis
Methods Development

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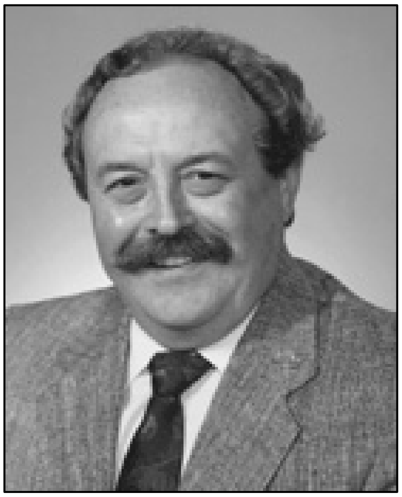
AGROCHEMICALS FELLOW AWARD PRESENTED TO TERRY SPITTLER

FOR OUTSTANDING CONTRIBUTIONS
TO THE ENDEAVORS OF THE DIVISION
&
TO THE SCIENCE OF PESTICIDE CHEMISTRY



Dr. Terry Spittler received the Agrochemicals Division Fellow Award at the 231st National Meeting & Exposition held in Atlanta, Georgia last spring. Dr. Spittler has been active in the Division since 1980, has been on numerous panels, and has organized several symposia. Over the years, he has served in capacity of each of the officer positions for the Division and is currently Treasurer.

Prior to joining Cornell University, Dr. Spittler received a BA in Chemistry and English from Bowling Green University, an MS in Biochemistry from SUNY Buffalo, and his Ph.D. in Physical-Organic Chemistry from SUNY Albany. He held post-doctoral positions at Syracuse University and Montana State University. In 1977, he joined New York Agricultural Experiment Station in Geneva in 1977 as Chief Chemist of the FS&T Analytical Division (the IR-4 and New York State Agriculture and Marketing Labs).

He became Senior Research Associate in 1984, held several positions in the National IR-4 Program, and then joined the Cornell Center for the Environment in 2000. In 2002, he was appointed Senior Research Associate in the Department of Horticultural Sciences and in 2005 he retired from this position and became a Visiting Fellow. He is a cooperator in research programs for microencapsulation/controlled release of nematicides and the identification of small peptides in plant vascular systems by anionic ion chromatography with pulsed amperometric quantitation.

Dr. Spittler is also a cofounder of Terrenew, LLC which will be located at the Cornell Agricultural and Food Technology Park. His interests are in organically-derived fibers for oil spill recovery and plant based heavy-metal exchange media for ground water/brown field remediation. In addition, he is a consultant for production of soil amendments from agricultural processing and municipal solid wastes.

Dr. Spittler lives in Geneva with his wife Mary, a retired art teacher. They have three grown children, Elizabeth, Max, and Gretehen. Terry's other interests include skiing, youth hockey, Geneva Classical Concerts, Inc., and hunting. He is also considered a gourmet gardener by the local deer.

The Officers and Executive Board

of the

AMERICAN CHEMICAL SOCIETY - DIVISION OF AGROCHEMICALS

and

BASF CORPORATION

will host a banquet in honor

of

Dr. Isamu Yamaguchi, President

Agricultural Chemicals Inspection Station

Tokyo, Japan

on

Monday September 11, 2006, 6 – 9 pm

At

Bank of America World Headquarters

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Reception and Social Hour 6 – 7 pm (cash bar)
Dinner 7 – 9 pm

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Entrée of
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Truffle Potatoes and Garlic Spinach
or
NY Steak with
Caramelized Onion and Sour Cream Whipped Potatoes

Warm Apple Crisp with Vanilla Bean Ice Cream
Rolls & Butter
Coffee or Tea

RSVP to:
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USDA/APHIS/National Wildlife Research Center
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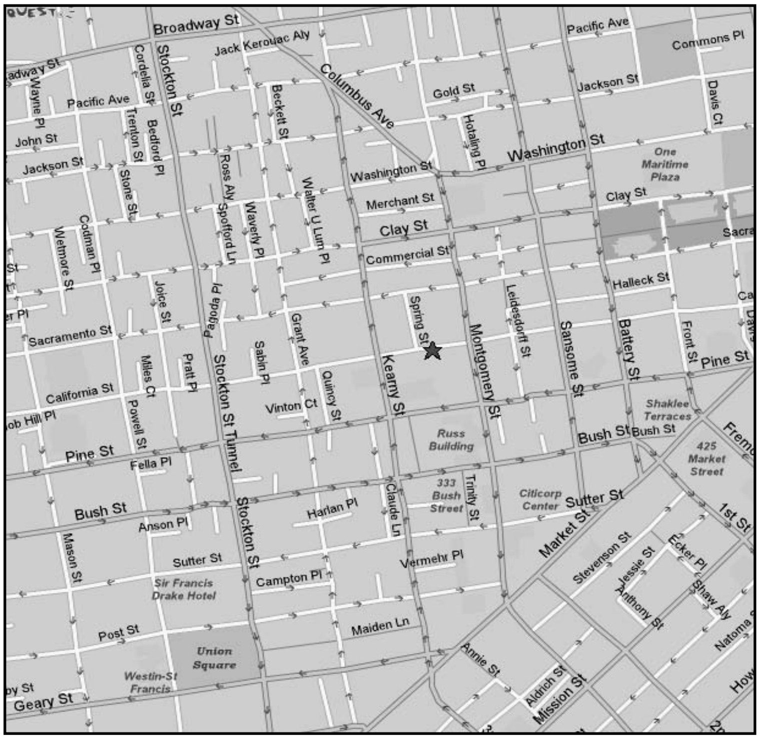
Fort Collins, CO 80521
(970) 266-6082
john.j.johnston@aphis.usda.gov

Payments and choice of entrée (Salmon or Steak)
must be received by August 25, 2006



INTERNATIONAL AWARD
FOR RESEARCH IN AGROCHEMICALS
PRESENTED BY THE AGROCHEMICAL DIVISION OF ACS

SPONSORED BY BASF CORPORATION

Dr. Isamu Yamaguchi has been the president of the Agricultural Chemicals Inspection Station (Incorporated Administrative Agency) since April 2005. He is an advisor for the 11th IUPAC International Congress of Pesticide Chemistry held in Kobe, Japan, August 2006. He has been a member of the Agrochemicals Division for 20 years.

Dr. Yamaguchi graduated from the Department of Agricultural Chemistry, finished the master course of Graduate School of Agriculture (Antibiotics) at The University of Tokyo, and joined RIKEN (The Institute of Physical and Chemical Research) in 1967. He obtained his Ph.D. from The University of Tokyo by presenting the thesis entitled, “Studies on the Metabolic Fate of Blasticidin S in the Environment.” Blasticidin S deaminase found in this study is a novel nucleoside deaminase. The successful cloning of its responsible genes, BSD and bsr, opened a new aspect of blasticidin S as a useful research agent in molecular biology. The BSD gene has been widely used in the world as a drug selectable marker.

Dr. Yamaguchi was a research associate at the University of Wisconsin and Michigan State University engaging in research on the action mechanism of heptachlor epoxide on synaptic ATPases in Dr. Matsumura’s laboratory (1976 – 1979). After returning to Japan, he conducted research on the interaction between plants and microorganisms and on plant disease control. He and co-workers obtained fruitful results on the action mechanism of non-fungicidal chemicals to control the rice blast disease, such as melanin biosynthesis inhibitors and the chemicals to induce systemic acquired resistance, metabolic degradation of persistent chemicals by rhizospheric microorganisms, and molecular breeding of disease-resistant plants.

Dr. Yamaguchi was appointed as the chief scientist of Microbial Toxicology Laboratory, RIKEN in 1985, and from 2000 to 2005, he served as a group director of Environmental Plant Research Group at RIKEN Plant Science Center. He was appointed as a visiting professor at the Graduate School of Saitama University, Toyo University, Tokyo University of Agriculture, University of California at Davis, Louis Pasteur University, and Zhejiang University of Technology. He was also invited as a lecturer at Tsukuba University, Nihon University, Chiba University ,and Tokyo University of Agriculture and Technology. Dr. Yamaguchi has served as an executive committee member of Pesticide Science Society of Japan and as president of the Society from 1999 – 2001. He has also served as the council member of the Phytopathological Society of Japan and of the Japan Society of Bioscience, Biotechnology, and Agrochemistry. He has written over 250 research and review papers.

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2006

STERLING B. HENDRICKS MEMORIAL LECTURESHIP AWARD

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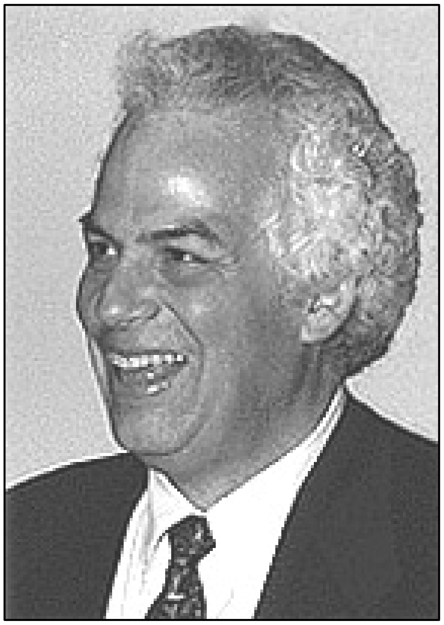
THE DIVISIONS OF AGROCHEMICALS AND AGRICULTURAL AND FOOD CHEMISTRY



Dr. Stanley B. Prusiner won the 1997 Nobel Prize in Physiology or Medicine for his discovery of prions, an entirely new genre of disease-causing agents, and for the elucidation of the underlying principles of their mode of action. It had previously been shown that Creutzfeldt-Jakob disease, kuru, and scrapie (a disease in sheep) could be transmitted through extracts of diseased brains. In 1982, Prusiner found that the infectious agent was comprised of a single protein which he named a prion, an acronym derived from "proteinaceous infectious particle." He subsequently showed that the prion gene was found in all animals tested, including humans, and that the prion protein could fold into two distinct conformations, one that resulted in disease and the other normal. It was then shown that the disease-causing prion protein had infectious properties and could initiate a chain reaction so that normal protein is converted into the disease-causing form.

Dr. Prusiner's work directly impacts agriculture since bovine spongiform encephalopathy, or mad cow disease, is a prion disease that can be transmitted to cows through feedstuff supplemented with offals from scrapie-infected sheep. This discovery provides important insights that may furnish the basis to understand the biological mechanisms underlying other types of dementia-related diseases, for example Alzheimer's disease, and establishes a foundation for drug development and new types of medical treatment strategies.

* * *

The **STERLING B. HENDRICKS MEMORIAL LECTURESHIP AWARD**, established in 1981, recognizes scientists who have made outstanding contributions to the chemical science of agriculture. Dr. Hendricks contributed to 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. Nominees may be outstanding, senior scientists in industry, universities, or government positions and current ARS employees are not eligible. The award includes an honorarium of $2000, a bronze medallion; expenses to present the Lecture. All of these costs are borne by ARS which selects the winner.

* * *

Following presentation of the Sterling B. Hendricks Award by the USDA-Agricultural Research Service, Dr. Prusiner will give an award address entitled, "Synthetic prions, mad cows, and scientific heresy." A reception and symposium will follow.

2006
STERLING B. HENDRICKS MEMORIAL LECTURESHIP SYMPOSIUM

MARRIOTT -- SALON 8

M. H. Tunick, Organizer, Presiding

8:00 — Introductory Remarks and Presentation of Award.

8:15 — 198. Synthetic prions, mad cows, and scientific heresy. **S. B. Prusiner**

9:00 — Reception.

9:30 — 199. Isolation and characterization of new anti-PrP monoclonal antibodies. **L. H. Stanker**, A. Serban, J. G. Safar, G. Legname, S. B. Prusiner

10:00 — 200. Mass spectrometric detection of attomole amounts of the prion protein, PrP 27-30, by nanoLC-MS-MS. **B. C. Onisko**, J. R. Requena, C. J. Silva, I. Dynin, J. M. Carter

10:30 — 201. Human prions and plasma lipoproteins. **J. G. Safar**, H. Wille, M. D. Geschwind, C. Deering, D. Latawiec, A. Serban, D. J. King, G. Legname, K. H. Weisgraber, R. W. Mahley, B. L. Miller, S. J. DeArmond, S. B. Prusiner

11:00 — 202. Mouse synthetic prions. **G. Legname**, F. E. Cohen, S. J. DeArmond, S. B. Prusiner

11:30 — 203. Chronic wasting disease of cervids. **M. W. Miller**

ABSTRACTS

AGFD 198. Synthetic prions, mad cows, and scientific heresy

Stanley B. Prusiner*, Institute for Neurodegenerative Diseases, University of California, San Francisco, Box 0518, San Francisco, CA 94143-0518, Fax: 415-476-8386, Stanley@ind.ucsf.edu*

The discovery of prions elucidated the cause of several neurodegenerative diseases including scrapie in sheep and bovine spongiform encephalopathy (BSE) in cattle as well as chronic wasting disease in free-ranging cervids. The discovery of prions also led to diagnostic tests that can be used to ensure the safety of the human food supply. The recent production of synthetic prions promises to facilitate advances in many areas of prion biology.

AGFD 199. Isolation and characterization of new anti-PrP monoclonal antibodies

Larry H. Stanker[1]*, Ana Serban*[2]*, Jiri G. Safar*[3]*, Giuseppe Legname*[2]*, and Stanley B. Prusiner*[3]*. (1) Foodborne Contaminants Research Unit, USDA-ARS Western Regional Research Center, 800 Buchanan St, Albany, CA 94710, Fax: 510-559-6429, lstanker@pw.usda.gov, (2) Institute for Neurodegenerative Diseases, University of California at San Francisco, (3) Institute for Neurodegenerative Diseases, University of California, San Francisco*

The prion diseases (or transmissible spongiform encephalopathies) are fatal neurodegenerative illnesses caused by the accumulation of PrPSc, which is an alternatively folded isoform of the cellular prion protein (PrPC). These disorders are widespread and are found in humans (Creutzfeldt-Jakob disease), in sheep (scrapie), in elk and deer (chronic wasting disease), and in cattle (bovine spongiform encephalopathy) as well as in mink and cats. Detection of PrPSc commonly relies on immunochemical methods. In this study, we isolated antibodies that improved the performance of the conformation-dependent immunoassay (CDI) used to measure both the protease-resistant and -sensitive forms of PrPSc. Following immunization of Prnp-null mice, a multitiered screening strategy was developed and a panel of candidate antibodies identified. Monoclonal antibody binding to PrP from different species, to reduced versus non-reduced PrP, to synthetic peptides, and to denatured PrP suggest that antibodies with both continuous and discontinuous epitopes were isolated. At least one of the antibodies, F4-31, substantially improved performance of the CDI for detection of PrPSc in cattle.

AGFD 200. Mass spectrometric detection of attomole amounts of the prion protein, PrP 27-30, by nanoLC-MS-MS

Bruce C. Onisko[1], *Jesús R. Requena*[2], *Christopher J. Silva*[1], *Irina Dynin*[1], *and John Mark Carter*[1]. *(1) FCR, USDA/ARS/WRRC, 800 Buchanan St., Albany, CA 94710, (2) Department of Microbiology, University of Santiago*

At present there are no methods to diagnose bovine spongiform encephalopathy (BSE) in live animals, or to assure a prion-free blood supply; and the result of prion infection is initiation of a neurodegenerative disease, invariably fatal after onset of symptoms. Prions have been shown to be present in blood by transfusion experiments, but based on infectivity found, the amount of misfolded prion protein in blood is estimated to be only 30-600 amol/mL. Quantitation of the prion protein was studied by use of nano-scale liquid chromatography coupled to a tandem mass spectrometer using multiple reaction monitoring. We successfully developed a method based on the detection of VVEQMCTTQYQK obtained by reduction, alkylation and digestion with trypsin of the proteinase K-resistant core known as PrP 27-30. The method exhibits a Limit of Detection of 20 amol, and has been used to quantitate the amount of PrP 27-30 in the brain of terminally ill Syrian hamsters.

AGFD 201. Human prions and plasma lipoproteins

Jiri G. Safar[1], *Holger Wille*[1], *Michael D. Geschwind*[2], *Camille Deering*[1], *Diane Latawiec*[1], *Ana Serban*[1], *David J. King*[1], *Giuseppe Legname*[1], *Karl H. Weisgraber*[3], *Robert W. Mahley*[3], *Bruce L. Miller*[2], *Stephen J. DeArmond*[4], *and Stanley B. Prusiner*[1]. *(1) Institute for Neurodegenerative Diseases, University of California at San Francisco, 513 Parnnassus Ave, San Francisco, CA 94143-0518, Fax: 415 476 8386, jsafar@ind.ucsf.edu, (2) Department of Neurology, Univerity of California at San Francisco, (3) Gladstone Institute, (4) Department of Pathology*

Prions are composed solely of an alternatively folded isoform of the prion protein (PrP), designated PrPSc. The polyoxometalate phosphotungstic acid (PTA) has been used to separate PrPSc from its precursor PrPC (the normal cellular isoform) by selective precipitation. In contrast to PrPC, PrPSc has not been solubilized using nondenaturing detergents Because of the similarities between PrPSc and lipoproteins with respect to hydrophobicity and formation of PTA complexes, we investigated whether these molecules bind to each other in blood. We found that prions from the brains of patients with sporadic Creutzfeldt-Jakob disease (sCJD) bind to very low-density and low-density lipoproteins (VLDL and LDL, respectively) but not to high-density lipoproteins (HDL) or other plasma components as demonstrated by both immunoassay and electron microscopy. Immunoassays demonstrated that apolipoprotein B (apoB), which is the major protein component of VLDL and LDL, also bound native PrPSc through a highly cooperative process. Exposure to 4 M guanidine (Gdn) HCl at 80°C for 20 min resulted in the release of approximately 50% of the PrPSc bound to LDL particles. The apparent binding constants of native human (Hu) PrPSc or denatured recombinant HuPrP(90–231) for apoB and LDL ranged from 28 to 212 pM. HuPrPSc was detected in VLDL and LDL fractions of plasma collected from sCJD patients but not in the HDL or immunoglobulin fractions. Whether detection of PrPSc in VLDL and LDL particles can be adapted into an antemortem diagnostic test for prions in the blood of humans and livestock remains to be determined.

AGFD 202. Mouse synthetic prions.

Giuseppe Legname, *Fred E. Cohen, Stephen J. DeArmond, and Stanley B. Prusiner, Institute for Neurodegenerative Diseases, University of California at San Francisco, 513 Parnassus Ave., San Francisco, CA 94143-0518, Fax: 415-476-8386, glegname@ind.ucsf.edu*

We recently produced infectious prions from purified recombinant prion protein (PrP) of mouse residues 89 to 230; MoPrP(89–230) was refolded into a highly β-sheet–rich amyloid preparation and inoculated into transgenic (Tg) mice harboring the same sequence. At least two novel mouse synthetic prion strains were identified as judged by: (i) incubation times, (ii) a conformational stability assay, and (iii) neuropathologic changes. These synthetic prions presented strain-specific characteristics that are distinct from all known naturally occurring prions. In another set of experiments, amyloid fibrils were produced using either truncated MoPrP(89–230) or full-length MoPrP(23–230), then injected into Tg mice expressing full-length MoPrP(23–231). Mice inoculated with either amyloid preparation developed prion disease in ~600 days. That prion infectivity could be generated *in vitro* from recombinant PrP supports the hypothesis that PrPSc is the sole component of the infectious agent responsible for the mammalian prion diseases.

AGFD 203. Chronic wasting disease of cervids

Michael W. Miller, *Wildlife Research Center, Colorado Division of Wildlife, 317 West Prospect Rd., Fort Collins, CO 80526-2097, Fax: 970-472-4457, mike.miller@state.co.us*

Chronic wasting disease (CWD) occurs naturally in North American deer (*Odocoileus* spp.), wapiti, and moose (collectively called “cervids”). CWD is contagious among its natural hosts, and epidemics can persist under both captive and free-ranging conditions, resulting in remarkably high infection rates. The precise mechanism of contagion remains unclear, although accumulations of disease-associated prion protein (PrP^{CWD}) in lymphatic tissues associated with the gastrointestinal tract suggest shedding via feces and perhaps saliva. CWD presently occurs in scattered foci throughout North America, both in the wild and in commercial facilities. Variation in cellular prion protein appears to influence CWD pathogenesis, and may provide a biological mechanism for emergence of variant strains within and among the four naturally susceptible species. The long-term implications of CWD for public, livestock, and wildlife health remain uncertain. Unfortunately, limitations of existing technology available to combat prion diseases make control of CWD ineffective or infeasible under most conditions.

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AGROCHEMICALS DIVISION EDUCATION AWARDS FOR GRADUATE STUDENT TRAVEL

WITH SPONSORSHIP BY DOW AGROSCIENCES

Fourteen graduate students have been awarded AGRO Division travel grants to present their research posters at the ACS National Meeting San Francisco Sci-Mix on Monday evening and at the AGRO poster session on Tuesday afternoon. The first, second, and third place winners will be announced at the Agrochemical Division's Social Hour on Tuesday evening. See pages 102 – 105 for Abstracts Nos. 129 – 142.

C. A. Curran	**AGRO 138.** Olfactory performance in salmonids exposed to aquatic herbicides. **C. A. Curran**, J. M. Grassley, C. E. Grue. University of Washington, Washington Cooperative Fish and Wildlife Research Unit, School of Aquatic and Fisheries Sciences, Box 355020, Seattle, WA 98195
L. J. Gereszek	**AGRO 136.** Effects of dietary conjugated linoleic acid on the European corn borer pupae and adults. **L. J. Gereszek**, D. C. Beitz J. R. Coats. Department of Entomology, Iowa State University, Ames, IA 50011
T. S. Goebel	**AGRO 134.** Modification of polymer flocculants for the removal of atrazine from water. **T. S. Goebel**, K. J. McInnes, S. A. Senseman, E. E. Simenak. Department of Soil & Crop Sciences, Texas A&M University, College Station, TX 77843
A. S. Gunasekara	**AGRO 130.** The sorption of thiobencarb to soils: Mechanistic findings. **A. S. Gunasekara**, T. M. Young, R. S.Tjeerdema. Department of Environmental Toxicology, University of California, Davis CA 95616
D. Hu	**AGRO 141.** Environmental fate of a veterinary antibiotic: tylosin **D. Hu**, K. L. Henderson, J. R. Coats. Department of Entomology, Iowa State University, Ames, IA**.** 50011
W. Hunter	**AGRO 129.** Using biomimetic PDMS fibers to determine the bioavailability of pyrethroids in sediment. **W. Hunter**, Y. Xu, J. Gan, F. Spurlock. Department of Environmental Science, University of California, Riverside, CA 92521
J. J. Keenan	**AGRO 132.** Indoor exposure to pyrethroid pesticides following fogger use or crack and crevice treatment by homeowners. **J. J. Keenan**, Y. Li, R. S. Gold, X. Zhang, G. Leng, R. I. Krieger. Department of Entomology, University of California, Riverside, CA 92521
K. A. King	**AGRO 137.** Response of pre-spawn coho salmon to pesticides in urban streams in Western Washington. **K. A. King**, C. E. Grue, J. W. Hearsey, J. M. Grassley. Aquatic and Fisheries Sciences, University of Washington, Seattle, WA 98195
H. Kosaki	**AGRO 140.** Environmental studies on the fate of pharma proteins produced in transgenic corn. **H. Kosaki**, J. Wolt, J. R. Coats. Department of Entomology, Iowa State University, Ames, IA 50011
S. H. Lancaster	**AGRO 131.** Effects of pesticide programs for cotton on soil microbial activity. **S. H. Lancaster**, S. A. Senseman, R. L. Haney, F. M. Hons, J. M. Chandler. Department of Soil and Crop Science, Texas A&M, College Station, TX 77843
K. R. Prihoda	**AGRO 139.** Examination of the fate of *Bacillus thuringiensis* Cry3Bb1 protein in a soil microcosm **Prihoda**, J. R. Coats. Department of Entomology, Iowa State University, Ames, IA**.** 50011
G. E. Schultz	**AGRO 135.** Evaluation of essential oil mixtures for mosquito repellency **G. E. Schultz**, J. Coats. Department of Entomology, Iowa State University, Ames, IA**.** 50011
V. Williams	**AGRO 142.** Proposed field study to evaluate phytoremediation and best management practices for removal of atrazine from agricultural runoff. **V. L. Williams**, J. R. Coats. Department of Entomology, Iowa State University, Ames, IA**.** 50011
B. Zhang	**AGRO 133.** MicroRNAs: New players in plant responses to agrochemicals and environmental stress. **B. Zhang**, T. A. Anderson. Dept. of Soil and Crop Science, Texas A&M, College Station, TX 77843

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CALL FOR NOMINATIONS
AGROCHEMICALS FELLOW AWARD

The 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 the agrochemical science over a period of at least six years.”

Nominations include a letter noting the contributions to the Division and a current curriculum vitae. Contact the Awards Committee for further information.

Dr. James Seiber
USDA-ARS, WRRC
800 Buchanan St.
Albany, CA 94710
510-559-5600 – phone
510-559-5963 – fax
jseiber@pw.usda.gov

Deadline for submitting nominations is May 31 of each year.

* * *

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	Dr. Philip C. Kearney
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	Dr. James P. Minyard, Jr.
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	Dr. Charles H. Van Middelem
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	Dr. Jack R. Plimmer
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1980	Dr. G. Wayne Ivie
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1975	Dr. Michael Elliot, Rothamsted Experiment Station, England
1976	Dr. Morton Beroza, USDA-ARS (retired)
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1978	Dr. Julius J. Menn, Stauffer Chemical
1979	Mr. Milton S. Schecter, USDA (retired)
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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
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1986	Dr. James Tumlinson, USDA-ARS, Gainesville, Florida
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   b. A **description** (200 – 1000 words) of the reasons why your nominee should receive this award, stressing the individual's major accomplishments.
   c. Nominations often include one or two letters of support, but this is optional.

Submitted by: ________________________ Date: _______________

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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 at the spring meeting of ACS.

The nominating official(s) should be prepared to assist in organizing a symposium and dinner at the National ACS meeting in honor of the awardee.
Please, return this completed form to:

Dr. James Seiber
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1987	Mary-Dell Chilton, Director of Biotechnology Research for Ciba-Geigy Corporation, Research Triangle Park, North Carolina
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2000	William S. Bowers, Professor, Department of Entomology and Chemical Ecology at the University of Arizona
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2003	Dr. Kriton Kleanthis Hatzios, VA Agricultural Experiment Station
2004	Dr. Robert L. Buchanan, Food & Drug Administration
2005	Dr. Donald Sparks, University of Delaware
2006	Dr. Stanley B. Prusiner, Institute for Neurodegenerative Diseases, University of California, San Francisco

CALL FOR NOMINATIONS
2007 STERLING B. HENDRICKS MEMORIAL LECTURESHIP

The Agricultural Research Service (ARS), USDA's primary research agency,
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2007 Sterling B. Hendricks Memorial Lectureship.

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.

Nominees may be outstanding, senior scientists in industry, universities, or government positions. Current ARS employees are not eligible. Nominations may be made by sending (1) a letter explaining the nominee's contributions to chemistry and agriculture and (2) a current curriculum vitae to:

Kim Kaplan, Lecture Coordinator
(301) 504-1637
at either
kaplan@ars.usda.gov
or
ARS Information Office
Room 1-2253, Mail Stop # 5128
5601 Sunnyside Ave
Beltsville, MD 20705

Electronic transmission is best; otherwise, use a carrier, such as FedEx.
The deadline for nominations is November 6, 2006.

The Lecture, on a scientific topic, trend, or policy issue of the Lecturer's choice, will be presented at the Fall American Chemical Society National Meeting (Boston, MA, August 19-23, 2007). The Division of Agricultural & Food Chemistry and The Division of Agrochemicals 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.

CALL FOR APPLICANTS
AGROCHEMICAL EDUCATION AWARDS

SUPPORT FOR GRADUATE STUDENT POSTER PRESENTATIONS AT THE 2007 FALL MEETING IN BOSTON

The Division of Agrochemicals has established an endowment fund that will be used to promote an understanding of the role of chemistry in agriculture as embraced in the following areas related to pest management chemistry: synthesis, metabolism, regulatory, biotechnology, delivery, risk assessment, resistance, residues, mode of action, and fate/behavior. To address this mission, awards will be made through the Division's Education Committee.

Proposals are sought for the 2007 awards. Graduate students will be awarded up to $600 each to help defray costs of attendance to give poster or oral presentations at the ACS 2007 Fall Meeting, which will be held August 19 – 23, 2007 in Boston. Posters will be displayed in a special poster session of the ACS Division of Agrochemicals as well as at the ACS Sci-Mix. A winner and two runners up will be selected for display at the Division's Social. The winner will receive an additional cash award of $500. The subject of the presentation should fall within the areas listed in the introductory sentence.

To apply, a graduate student should submit the following, to be received no later than May 1, 2007:

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 letter of nomination from the faculty advisor.

Submit the above electronically with the three items as attachments in either Word or Word Perfect to: Dr. John J. Johnston at john.j.johnston@aphis.usda.gov.

Direct questions to:
Dr. John J. Johnston
USDA/APHIS/National Wildlife Research Center,
4101 LaPorte Ave
Fort Collins, CO 80521
(970)-266-6082.

Abstracts will be reviewed by the Education Committee; submitters will be notified of their selection status in May 2007.

CALL FOR APPLICANTS
YOUNG SCIENTIST PRE- AND POST-DOCTORAL RESEARCH AWARDS & SYMPOSIUM

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Major Professor/Supervisor ________________________________

Will you present this paper even if you do not receive an award: YES__________ NO__________

WITH THIS APPLICATION FORM INCLUDE THE FOLLOWING:

1. An extended abstract of your presentation (4 pages maximum including figures and tables) that clearly describes the nature of the work (hypothesis, methods, results), its relationship to previous research, and its significance for the field of agrochemicals.
2. An abstract of 150 words (submit directly to http://oasys.acs.org/oasys.htm); this short abstract will be printed in the Agrochemicals Division biannual publication, PICOGRAM.

MAIL OR FAX THIS SIGNED APPLICATION; FAX OR EMAIL AN EXTENDED ABSTRACT TO:

Dr. Allan Felsot, Washington State University, FEQL, 2710 University Dr., Richland, WA 99354
Phone: 509-372-7365; Fax: 509-372-7460; email: afelsot@tricity.wsu.edu

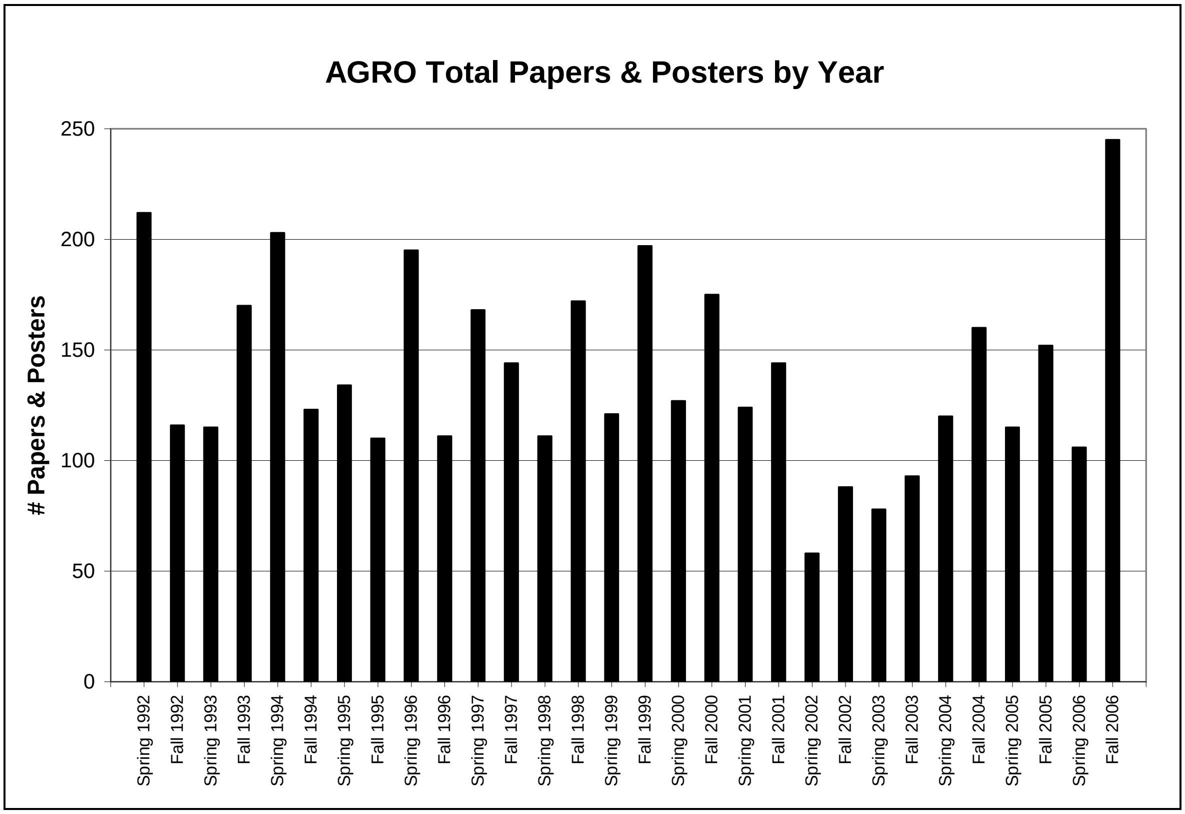
****DEADLINE FOR SUBMITTAL OF APPLICATION MATERIALS: November 5, 2006****

NOTE: *Two awards will be made based on the merits of the submitted applications. Applicants not winning the awards will be invited to present their research in the Young Scientist's Recognition Symposium and will be eligible to receive a small travel grant.*

NOTES FROM THE PROGRAM CHAIR

Laura L. McConnell

Programming for the 232nd National Meeting in San Francisco is impressive in quality, quantity, and diversity. The symposia included at this meeting address regional issues specific to California; emerging issues of national importance; and a return to topics historically included in AGRO programming. At 245 papers, including 63 posters, San Francisco represents the largest program that AGRO has sponsored since Spring 1992 (also in San Francisco). This speaks to the dedicated membership of the AGRO Division and their enthusiasm in developing exciting symposium topics and reaching out to the broader scientific community to bring new participants to ACS. Thank you to all of the symposium organizers who have worked so hard to create such an excellent program. I have thoroughly enjoyed my year as Program Chair, and I am looking forward to serving as Division Chair in 2007.



Some specific programming notes to keep in mind:

1. The AGRO poster sessions will be held on Tuesday afternoon from 1:00 – 5:00 pm in the Moscone Convention Center, Hall D. This will include the Graduate Student Travel Award Poster session, General Posters, and Posters submitted for the Immunochemistry and Pyrethroid symposia.
2. The International Award Symposium will be held on at 8 am, Monday, September 11, in the Marriott Salon 1. Please support our International Award winner by attending Dr. Yamaguchi's address.
3. The Sterling B. Hendricks Memorial Lectureship will be presented to the Nobel Laureate, Stanley B. Prusiner. His paper, entitled, "Synthetic prions, mad cows and scientific heresy," will be presented at 8 am Wednesday, Spetember 13 in the Marriott, Salon 8. All AGRO programming will be delayed until 9 am on Wednesday morning to encourage attendance at this event.

An open programming meeting will be held on Wednesday afternoon, September 13, from 5:00 – 6:00 pm in the Marriott, Salon 4/5, to discuss *Future AGRO Programming and Symposium Organizer Information*. Please voice your ideas about the future direction of AGRO programming and find out more about being a symposium organizer. Refreshments will be served!

FALL 2006 SCHEDULE

ALL SYMPOSIA/Sessions will be at the SAN FRANCISCO MARRIOTT in Salons 1, 2, and 3 except for the Sterling Hendricks Lectureship Award which will be in Salon 8.
The POSTER SESSION will be at the MOSCONE CONVENTION CENTER, Hall D.

A=AM; D=AM & PM; E=EVENING; P=PM; PS=Poster Session

SYMPOSIUM OR SESSION	ORGANIZER(S)	Sun	Mon	Tue	Wed	Thu
Agrochemical Residue & Metabolism Chemistry	T. Wehner J. Johnston D. Smith	D				
Alternatives to the Use of Methyl Bromide in Pre-Plant Soil Fumigation and Stored Commodities	L. Ruzo R. M. Bennett	D	D			
ACS International Award for Research in Agrochemicals: Symposium in Honor of Isamu Yamaguchi: Fungicides	J. Clark		D			
Synthetic Pyrethroids and Surface Water Quality	J. Gan F. Spurlock P. Hendley		D	D		
Sci-Mix	L. McConnell		E			
The Future Role of Pesticides in Agriculture	S. Lehotay L. McConnell			D		
Agricultural Impacts on Air Quality	L. McConnell C. Hapeman M. Majewski J. Seiber O. Hertel			D	D	A
Weed Resistance to Herbicides	W. Ridley R. Sammons A. Felsot			P	A	
New Developments in Agrochemical Research (General Posters)	L. McConnell			PS		
Agrochemical Education Awards For Graduate Student Travel: Research Poster Presentations	J. Johnston			PS		
Recent Advances in Immunochemistry and their Applications to Agrochemicals (Poster Session)	J. Van Emon W. Shelver			PS		
Synthetic Pyrethroids and Surface Water Quality (Poster Session)	J. Gan F. Spurlock P. Hendley			PS		
Sterling B. Hendricks Memorial Lectureship in Honor of Stanley Prusiner *Co-sponsored with AGFD*	M. Tunnick J. Seiber			A		
Plant Nutrient Issues Impacting Trade, Water, Air, and Soils	B. Hall				D	
Recent Advances in Immunochemistry and Their Applications to Agrochemicals	J. Van Emon W. Shelver				P	D
Characterizing Natural Products as Pesticides, Repellents, or Biomarkers	R. Stahl					P

AGRO PROGRAM COMMITTEE REPORT

In response to initiatives developed at the AGRO Long Range Planning Workshop, the Program Committee of AGRO has been recreated with a specific goal:

> *"Establish a program planning structure for AGRO to provide continuity and sustained outstanding scientific program."*

The newly formed 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 Laura McConnell, Joe Massey, or one of the division officers.

Standing Programming and New Directions

A recent activity carried out by the committee was to establish a draft list of standing topic areas which reflect better the broader areas of agricultural research being addressed by AGRO.

- 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
- Human and Animal Health Protection: Veterinary Pharmaceuticals, Antimicrobials, Worker Protection Products
- Advances in Agrochemical Residue and Metabolism Chemistry
- 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

These topics will be part of each AGRO program beginning in 2008 along with our normal awards, programming, and symposia to address ACS themes for each meeting and special topics of emerging or continuing interest.

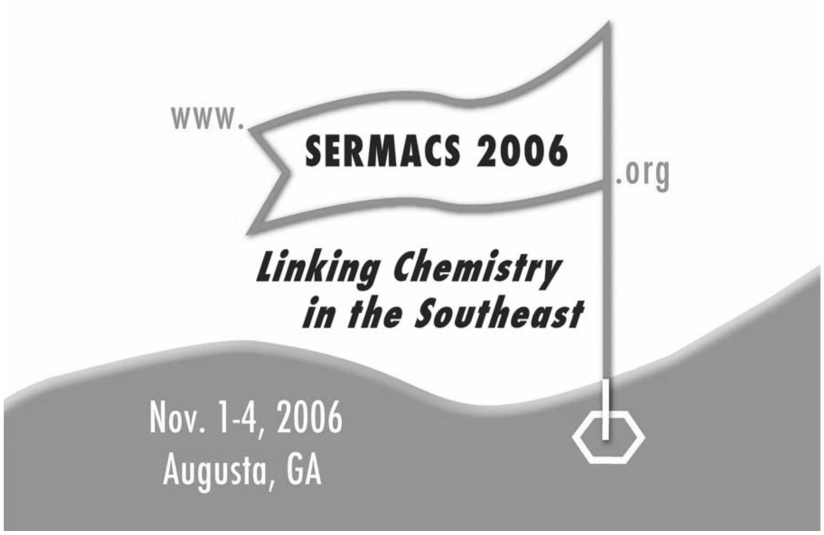
If you have additional ideas for standing topics or programming that you would like to see included in AGRO, please contact one of the division officers or attend our Future AGRO Programming Discussion and Symposium Organizer Information meeting on Wednesday, September 13 at 5:00 pm in the Marriott, Salon 4/5.

STATUS OF PLANNED
AGRO PROGRAMMING & OUTREACH ACTIVITIES
2006 – 2010

Activity/Event	Leader(s)	Status	Actions Required
ACS National Meeting September 10 – 14, 2006 San Francisco, California	Laura McConnell	Program in place	• Prog.Com. Meeting 9/10/06 • Future AGRO Programming Discussion 9/13/06 at 5 pm
IUPAC Pesticide Congress August 7 – 10, 2006 Kobe, Japan	Ken Racke Laura McConnell	AGRO banners and books available at a table in exhibition hall	• Need volunteers to person table during the conference
SERMACS 2006 ACS Regional Meeting Nov 1 – 4, 2006 Augusta, Georgia http://www.sermacs2006.org/ Co-sponsorship	Laura McConnell	• See Call for Papers page 34 • AGRO sponsoring two sessions - Turf Chemistry - Developments in Agricultural Chemistry • Place to set up a table with AGRO banners and books	• Speakers needed for this program especially from those who live in the Augusta/Atlanta area • Great opportunity for students to present work in smaller environment
233rd ACS National Meeting March 25 – 29, 2007 Chicago, Illinois	John Johnston	See Call for Papers, pages 35 – 36, 38 – 45	
234th ACS National Meeting August 19 – 23, 2007 Boston, Massachusetts	John Johnston	See Call for Symposia & Papers, page 37	• Contact John if you are interested in organizing a symposium
4th Pan Pacific Conference on Pesticide Science June 1 – 4, 2008 Honolulu, Hawaii	Al Barefoot Joel Coats	• Organizing & Science Program Committees holding preliminary meetings • Pesticide Science Society of Japan will co-sponsor	
236th ACS National Meeting August 17 – 21, 2008 Philadelphia, Pennsylvania	Vice chair elected in 2006/7	Call for Symposia & Papers TBA in PICOGRAM vol. 72	
Activities beyond 2008			
AGRO Workshop 2009 *Topic TBA*	John Clark Ken Racke		
238th ACS National Meeting August 16 – 20, 2009 Washington, DC			
240th ACS National Meeting August 22 – 26, 2010 Boston, Massachusetts			
IUPAC Pesticide Congress Summer 2010 Melbourne, Australia		AGRO should exert a strong presence at this meeting. In the meantime, AGRO should decide whether to pursue a proposal to host the 2014 Pesticide Congress in the U.S.	

AGRO Program Committee			
Laura McConnell, 2006 Program Chair		mcconnel@ba.ars.usda.gov	
Joseph Massey, 2006 – 2010 Long Range Program Coordinator		jmassey@pss.msstate.edu	
Division & Subdivision Officers			
Donald Wachoupe	Division Chair	don.wauchope@tifton.usda.gov	
John Johnston	Vice Chair	John.J.Johnston@usda.gov	
Bill Hall	Chair, FERT Subdivision	bill.hall@mosaicco.com	
Terry Spittler	Treasurer	tds2@cornell.edu	
Aldos Barefoot,	Secretary	Aldos.C.Barefoot@USA.dupont.com	
Allan Felsot	Immediate Past Chair	afelsot@tricity.wsu.edu	
Barry Cross	Councilor	barry.cross@worldnet.att.net	
Standing Members			
Jim Seiber	Awards Committee Chair	jseiber@pw.usda.gov	
Allan Felsot	Young Scientist Award Chair	afelsot@tricity.wsu.edu	
John Johnston	Education Award Committee Chair	John.J.Johnston@usda.gov	
John Clark	Special Conferences Chair	jclark@vasci.umass.edu	
Cathleen Hapeman	Publication Committee Chair	hapemanc@ba.ars.usda.gov	
Jason Sandahl	International Outreach Chair	Jason.Sandahl@usda.gov	
Executive Committee Members			
Todd Anderson	todd.anderson@ttu.edu	Ken Racke	kracke@dow.com
Jeff Bloomquist	jbquist@vt.edu	Pamela Rice	pamrice@umn.edu
Matthew Brooks	mwbrooks01@yahoo.com	Patricia Rice	ricep@basf-corp.com
John Clark	jclark@vasci.umass.edu	Luis Ruzo	l.ruzo@ptrlwest.com
Cathleen Hapeman	hapemanc@ba.ars.usda.gov	Teresa Wehner	teresa.wehner@merial.com
Marty Kovacs	marty@toxcel.com	Jeanette Van Emon	vanemon.jeanette@epamail.epa.gov
Ann Lemley	atl2@cornell.edu		
Volunteer Members 2006 – 2009			
Ellen Arthur	ellen.arthur@bayercropscience.com	Michael Meyer	mmeyer@usgs.gov
Ralph Mumma	rom1@psu.edu	Scott Yates	syates@ussl.ars.usda.gov

CALL FOR PAPERS
SERMACS REGIONAL MEETING



Hosted by:
The ACS-Savannah River Section
in collaboration with
The AIChE-Central Savannah River Section

More than 20 symposia!

The Division of Agrochemicals will co-sponsor symposia in:

- Turf Chemistry
- Developments in Agricultural Chemistry

AGRO 2007
CALL FOR SYMPOSIA & PAPERS

The following symposia are planned for the ACS National Meetings in 2007 in Chicago and Boston. Proposals for additional symposia are now being accepted for both meetings. Please contact:

Dr. John Johnston, AGRO 2007 Program Chair
Chemistry Research Project
USDA/APHIS/WS/National Wildlife Research Center
4101 LaPorte Avenue
Fort Collins, CO 80521
e-mail: john.j.johnston@aphis.usda.gov
Phone: (970) 266-6082
Fax: (970) 266-6089

233rd ACS NATIONAL MEETING
CHICAGO, ILLINOIS
MARCH 25 – 29, 2007

ACS International Award for Research in Agrochemicals will honor Dr. Gerald T. Brooks for his research contributions in the study of the biochemical toxicology of insecticides.

Young Scientist Pre- and Post-Doctoral Research Award Symposium
(Oral Presentations Only – page 29)
Organizer: Allan Felsot, Washington State University, 509-372-7365, afelsot@tricity.wsu.edu

Agricultural Biomass, Biobased Products, and Biofuels (oral/poster sessions – page 38)
Organizers: James Seiber, USDA-ARS, James Seiber-Inter2.ARS@gw; Cathleen Hapeman, USDA-ARS, 301-504-6451, hapemanc@ba.ars.usda.gov; Justin Barone, USDA-ARS, 301-504-5905, baronej@ba.ars.usda.gov; Joseph Massey, Mississippi State University, 662-325-4725, jmassey@pss.msstate.edu

Analytical Advancements In Nutrient Analysis and Agricultural Contaminant Detection (oral/poster sessions – page 39)
Organizer: Bill Hall, Mosaic Phosphates, 863-428-7161, Bill.Hall@mosaicco.com

Drought: Issues for Food Production and a Sustainable Environment (oral/poster sessions – page 40)
Organizers: John Finley, A.M. Todd Group, jfinley@amtodd.com; Jane Leland, Kraft Foods, 847-646-7491, jleland@Kraft.com; Scott Yates, USDA-ARS, 951 369-4803, syates@ussl.ars.usda.gov

Estimation of Environmental Exposure to Agrochemicals Using Spatial Data Analysis and Geographic Information Systems (oral/poster sessions – page 41)
Organizers: Scott Jackson, BASF, scott.jackson@basf.com; Robert Gilliom, U.S. Geological Survey, rgilliom@usgs.gov; Paul Hendley, Syngenta Crop Protection, Inc., paul.hendley@syngenta.com

Glyphosate Resistant Crops and Weeds: Present and Future (Invited Papers)
Organizers: Stephen Powles, University of Western Australia, 61-8-93807833, spowles@agric.uwa.edu.au; Stephen Duke, USDA-ARS, 662-915-1036, sduke@olemiss.edu

AGRO 2007
CALL FOR SYMPOSIA & PAPERS
(continued)

New Developments and Issues in Agrochemical Sciences (oral/poster sessions – page 42)
Organizer: John Johnston, USDA/APHIS/WS/National Wildlife Research Center, 970-266-6082, john.j.johnston@aphis.usda.gov

Recent Advances in Sustainable Household, Structural and Residential Pest Management (oral/poster sessions – page 43)
Organizers: Chris Peterson, USDA/Forest Service, 662-325-0199, cjpeterson@fs.fed.us; Daniel Stout, US EPA, 919-541-5767, stout.dan@epa.gov

Sustainable Forest Pest Management (oral/poster sessions – page 44)
Organizers: Ellen Arthur, Bayer CropScience, 913-433-5328, ellen.arthur@bayercropscience.com; Chris Peterson, USDA Forest Service, 662-325-0199, cjpeterson@fs.fed.us; Randy Ripperger, Bayer CropScience, 913-433-5316, randy.ripperger@bayercropscience.com

Veterinary Pharmaceuticals in the Environment (oral/poster sessions – page 45)
Organizers: Keri Henderson, Iowa State University, 515-294-8667, hendersk@iastate.edu; Joel Coats, Iowa State University, 515-294-4776, jcoats@iastate.edu

AGRO 2007
CALL FOR SYMPOSIA & PAPERS
(continued)

234th ACS NATIONAL MEETING
BOSTON, MASSACHUSETTS
AUGUST 19 – 23, 2007

ACS International Award for Research in Agrochemicals will honor Dr. Frederick J. Perlak for his research contributions in the area of insect protected crops

Sterling B. Hendricks Award (See page 27)
Please contact AGRO Program Chair for nominations

Agrochemical Education Awards For Graduate Student Travel: Research Poster Presentations
Organizer: John J. Johnston, USDA/APHIS/WS/National Wildlife Research Center, 970-266-6082, john.j.johnston@aphis.usda.gov

Agrochemical Residue & Metabolism Chemistry
Organizers: Teresa A. Wehner, Merial Ltd; J. J. Johnston, USDA/APHIS/WS, 970-266-6082, john.j.johnston@aphis.usda.gov; David Smith, USDA-ARS, (701) 239-1238, smithd@fargo.ars.usda.gov

Advances and Applications of QSAR in Agrochemical Research – A Symposium to Honor Phil Magee
Organizers: John H. Block, Oregon State University, 541-737-5779, John.Block@oregonstate.edu; Robert Clark, Tripos Inc., bclark@tripos.com

Climatic Issues and Research: Impacts on Agriculture
Please contact AGRO Program Chair if you are interested in participating in this symposium

Developments in Integrated Pest Management
Organizer: Ames Herbert, Extension Entomologist, 757-657-6450 ext 122, herbert@vt.edu

Evaluation of Agriculturally-Related Chemicals: Impacts on Environmental, Animal, & Human Health
Organizers: Pamela Rice, USDA-ARS 612-624-9210, pamrice@umn.edu; Todd Anderson, Texas Tech University, 806-885-4567, todd.anderson@tiehh.ttu.edu; Ellen Arthur, Bayer CropScience, 913-433-5328, ellen.arthur@bayercropscience.com; Patricia Rice, BASF, 919-547-2668, patricia.rice@basf.com

Rodenticides for the Protection of Public Health, Agriculture, and Natural Resources
Organizer: Thomas Primus, USDA/APHIS/WS/National Wildlife Research Center, 970-266-6065, thomas.m.primus@aphis.usda.gov

Nanotechnology in Agriculture
Please contact AGRO Program Chair if you are interested in participating in this symposium

New Developments and Issues in Agrochemical Sciences (General Oral Presentations and Posters)
Organizer: John J. Johnston, USDA/APHIS/WS/National Wildlife Research Center, 970-266-6082, john.j.johnston@aphis.usda.gov

CALL FOR PAPERS

Agricultural Biomass, Biobased Products, and Biofuels

233rd ACS National Meeting
Chicago, Illinois
March 25 – 29, 2007

Purpose of Symposium

To highlight and to discuss research and advances in agriculturally-derived products including substitutes for oil-based products. Sources for such products include: crop by-products (straw, prunings, etc.), animal byproducts (manure, feathers, etc.), food processing by-products (milling, ginning, slaughterhouses, off-quality produce).

Suggested Topics

- Feedstock Development
  - Plant Cell Wall
  - Energy Crops (e.g., Switchgrass)
  - Industrial Crops (soy, guayule, lesquerella, castor)
  - Agriculturally-Based Biorefinery
  - Role of Genetic Improvement
  - Sustainability (e.g., soil conservation, pest control)
- Biofuels
  - Corn to Ethanol
  - Alternatives or Other Crops (e.g., wheat, barley)
  - Biodiesel
  - Other Forms of Bioenergy Production
    - Landfill gas
    - Pyrolysis, gasification, etc.
- Biobased Products
  - Industrial Chemicals
  - Fibers, Nanoparticles
  - Oils, Latex
  - Pesticides
  - Cloth, Wood, Pellets, etc.
  - Polymers

For additional information contact the organizers

James Seiber, Director, USDA-ARS, 510-559-5600, James Seiber-INTER2.ARS@gw
Justin Barone, USDA-ARS, 301-504-5905, baronej@ba.ars.usda.gov
Cathleen Hapeman, USDA-ARS, 301-504-6451 hapemanc@ba.ars.usda.gov
Joseph Massey, Mississippi State University, 662-325-4725 jmassey@pss.msstate.edu

Abstracts should be submitted August 28 – November 15, 2006

CALL FOR PAPERS

Analytical Advancements in Nutrient Analysis and Agricultural Contaminant Detection

233rd ACS National Meeting
Chicago, Illinois
March 25 – 29, 2007

Purpose of Symposium

To highlight and to discuss analytical advancements and method research in the detection and analysis of agricultural contaminants and plant nutrients. Agriculture presents many complex and difficult matrices for analytical, environmental, and product chemists. Soils, plants, manures, fertilizers and other agrochemical products present unique challenges for sampling, extraction, and detection of analytes. Furthermore, concentrations can range from detection limit/trace levels to macro levels found in concentrated products. These wide ranges are prompted by regulatory as well as nutritional and product-claim drivers. New and innovative methods are being developed to better address the needs of analysts charged with these analyses. Current research and new methods will be presented that can be used to better manage these analytical challenges affecting, soil, food, water, and agricultural products.

Suggested Topics

- Contaminant Analysis
  - Trace Metals – in soils, fertilizers, micronutrients, and organic matrices
  - Perchlorate – in soils, sludges, and other high TDS samples
  - Pesticide Residues – on foods, in soils and water
  - Drug Residues – in manures and soils
  - Other contaminants of interest
- Nutrient Analysis
  - N-P-K Nutrient analysis – Total, available, and slowly released
  - Secondary Nutrient Analysis – Total, soluble, and available
  - Micronutrient Analysis – Total and soluble sources
  - Beneficial versus Essential Nutrients – Understanding and detecting differences
- Environmental Analysis
  - Water – Rainfall, irrigation, and ground and drinking waters
  - Air – Drift, PM 2.5 and 10.0, upper levels of the atmosphere
  - Contaminated soils, sludges and washout areas
  - Plant Emissions – Stack sampling, ambient air, and water discharges
  - Forensic Testing - Fingerprinting for source identification of pollutants

For additional information contact the organizer

Bill Hall, Mosaic Fertilizer LLC, 863-428-7161, bill.hall@mosaicco.com

Abstracts should be submitted August 28 – November 15, 2006

CALL FOR PAPERS

Drought: Issues for Food Production and a Sustainable Environment

233^{rd} ACS National Meeting
Chicago, Illinois
March 25 – 29, 2007

Purpose of Symposium

Drought is a relatively common occurrence that produces devastating effects on society. The symposium will provide a historical perspective and examine the state of the science for identifying and mitigating the effects of drought on food supplies and agriculture and environmental systems.

Suggested Topics

- Historical Perspectives
- Drought Impacts on Food Supply
  - Issues/Problems
  - Economics
  - Research & Solutions
- Water Use and Water Quality
  - Water use efficiency
    - Irrigation methodology
    - Ground water management
    - Desalinization/treatment
    - Urban water use
  - Water Reuse: Perspectives
    - Public health
    - Environment
    - Economics
  - Drainage water disposal
  - Soil salinization
  - Soil reclamation/restoration/land retirement
  - Balancing ecological water needs
- Biotechnology
  - Drought-resistant crops
  - Salt-tolerant plants
  - Development of alternative cropping systems
  - Food & environmental safety
    - Genetic modifications
    - Other issues (i.e., trace elements)
  - Economics and limiting issues
- Effect of Regulation on Food Production
  - Biotechnology
  - Chemical use
  - Biological control
  - Ecological systems

For additional information contact the organizers

John Finley, A.M. Todd Group, jfinley@amtodd.com; Jane Leland, Kraft Foods, 847-646-7491, jleland@Kraft.com; Scott Yates, USDA-ARS, 951-369-4803, syates@ussl.ars.usda.gov

Abstracts should be submitted August 28 – November 15, 2006

CALL FOR PAPERS

Estimation of Environmental Exposure to Agrochemicals Using Spatial Data Analysis and Geographic Information Systems

233rd ACS National Meeting
Chicago, Illinois
March 25 – 29, 2007

Purpose of Symposium

Over the last ten years, there has been an accelerating use of spatial data analysis approaches and Geographic Information Systems (GIS) to estimate exposure from agrochemicals. The use of these approaches has been more-specifically applied to refine understanding of the potential for agrochemicals to move from a site of application to non-target receiving waters (e.g., surface or groundwater), or to impact non-target organisms. These approaches have been used to refine initial assumptions used in deterministic exposure modeling, to understand the context of specific model scenarios or field study sites, and to extrapolate exposure estimates to unmonitored areas. In the USA, this has been facilitated by ready access to an ever-increasing pool of relevant, high-quality spatial datasets. This symposium will examine ways in which these spatial data analysis and GIS approaches have refined the science of agrochemical exposure assessment, and will identify future needs to continue to expand our ability to model and understand the agricultural landscape.

Suggested Topics

Primary themes will include the use and application of spatial data analysis methods and GIS to refine estimates of surface water, ground water, and terrestrial exposure, and the use and development of data layers and coverages for spatial approaches. Subtopics include the use of spatial approaches to:

- Estimate probable exposure levels for areas where monitoring has not yet been conducted
- Understand the impact of spatially-varying landscape properties, such as soil and climatic characteristics, on predictions of probabilities of exposure at local and regional scales
- Develop scenarios for exposure modeling and conducting probabilistic landscape level exposure assessments within a GIS
- Quantify impact of exposure mitigation by management practices (e.g., vegetative buffer areas)
- Examine landscape features and their proximity to receiving waters using remote/aerial imagery
- Describe geographic distribution of agrochemical exposure in ecosystems of special interest

For additional information contact the organizers:

Scott Jackson, BASF, scott.jackson@basf.com
Robert Gilliom, U.S. Geological Survey, rgilliom@usgs.gov
Paul Hendley, Syngenta Crop Protection Inc, paul.hendley@syngenta.com

Abstracts should be submitted August 28 – November 15, 2006

CALL FOR PAPERS

New Developments and Issues in Agrochemical Sciences

233rd ACS National Meeting
Chicago, Illinois
March 25 – 29, 2007

Purpose of Symposium

This symposium is open to all topics related to agricultural chemistry which are not pertinent to other symposia

Suggested Topics Include

Formulation Chemistry
Toxicology
Mode of Action
Computer Modeling
Synthesis
Environmental Fate
Regulatory Science
Organic Farming
Agricultural Contaminants
Water Quality
Nanotechnology
Pest Attractants/Repellents
Natural Products

For additional information contact

John J. Johnston
USDA/APHIS/WS/National Wildlife Research Center
4101 LaPorte Ave.
Fort Collins, CO 80521
970-266-6082
john.j.johnston@aphis.usda.gov

Abstracts should be submitted August 28 – November 15, 2006

CALL FOR PAPERS

Recent Advances in Sustainable Household, Structural, and Residential Pest Management

233rd ACS National Meeting
Chicago, Illinois
March 25 – 29, 2007

Purpose of Symposium

Pesticides are used extensively in our homes, schools, and workplaces. This symposium will examine efforts to provide safe and efficacious pest management products for use in and around the home, school, and workplace. It will also examine pesticide exposure and risk assessment, environmental fate and effects.

Suggested Topics

New Active Ingredients for Management of Insects, Weeds, and Fungi
- Household and Structural
- Landscape/Turf
- Ornamental
- Parasites/Disease Vectors
- Trees/Urban Forestry

Efficacy Evaluation
Regulation
Human Exposure/Risk Assessment
Environmental Fate and Effects

For additional information, contact the organizers

Chris Peterson, USDA Forest Service, (662) 325-0199, cjpeterson@fs.fed.us
Daniel Stout, US EPA, (919) 541-5767, stout.dan@epa.gov

Abstracts should be submitted August 28 – November 15, 2006

CALL FOR PAPERS

Sustainable Forest Pest Management

233^{rd} ACS National Meeting
Chicago, Illinois
March 25 – 29, 2007

Purpose of Symposium

To examine pest control tools, strategies and best management practices in natural, production and urban forest scenarios, to understand the efficacy and fate of pest control measures and to evaluate non-target effects of these practices

Suggested Topics

- Control and Management of Forest Insects, Weeds, and Fungi
- Chemical Control
    - New Active Ingredients
    - Efficacy
    - Environmental Fate
- Biological Control
- Non-target Effects
    - Soil Insects
    - Aquatic Invertebrates
    - Soil Health
- Best Management Practices
    - Integrated Approaches (including IPM)
    - Buffers

For additional information contact the organizers

Ellen Arthur, Bayer CropScience, 913-433-5328, ellen.arthur@bayercropscience.com
Chris Peterson, USDA Forest Service, 662-325-0199, cjpeterson@fs.fed.us
Randy Ripperger, Bayer CropScience, 913-433-5316,
randy.ripperger@bayercropscience.com

Abstracts should be submitted August 28 – November 15, 2006

CALL FOR PAPERS

Veterinary Pharmaceuticals in the Environment

233^{rd} ACS National Meeting
Chicago, Illinois
March 25 – 29, 2007

Purpose of Symposium

To bring together scientists from academia, government, and industry to discuss and present data relevant to the significance of veterinary pharmaceuticals in the environment

Suggested Topics

- Fate studies:
  - Physico-chemical properties
  - Sorption/desorption
  - Mobility in soil
  - Persistence in environmental matrices (e.g., manure, soil, water)
  - Bioavailability in soil, sediment, or water
  - Analytical techniques
  - Environmental monitoring and exposure
- Ecotoxicological studies on aquatic, benthic, or soil organisms
- Risk assessment

For additional information contact the organizers

Keri Henderson, Iowa State University, 515-294-8667, hendersk@iastate.edu
Joel Coats, Iowa State University, 515-294-4776, jcoats@iastate.edu

Abstracts should be submitted August 28 – November 15, 2006

OFFICERS AND COMMITTEES OF THE DIVISION OF AGROCHEMICALS

AGRO DIVISION OFFICERS

Division Chair Dr. R. Donald Wauchope	(229) 386-3892	FAX: (229) 386-7215	don.wauchope@tifton.usda.gov
Program Chair Dr. Laura L. McConnell	(301) 504-6298	FAX: (301) 504-5048	mcconnel@ba.ars.usda.gov
Vice Chair Dr. John J. Johnston	(970) 266-6082	FAX: (970) 266-6089	John.J.Johnston@aphis.usda.gov
Secretary Dr. Aldos C. Barefoot	(302) 451-5856	FAX: (302) 351-6656	aldos.c.barefoot@usa.dupont.com
Treasurer Dr. Terry Spittler	(315) 787-2283	FAX: (315) 787-2320	tds2@cornell.edu

EXECUTIVE COMMITTEE

2004 – 2006	2005 – 2007	2006 – 2008
Dr. Randy Weintraub	Dr. Matthew Brooks	Dr. Todd Anderson
Dr. Jeff Bloomquist	Dr. Marty Kovacs	Dr. Cathleen Hapeman
Dr. John Clark	Dr. Ann Lemley	Dr. Patricia Rice
Dr. Kenneth Racke	Dr. Teresa Wehner	Dr. Luis Ruzo
Dr. Pamela Rice	Dr. Paul Zubkoff	Dr. Jeanette Van Emon

COUNCILORS

2004 – 2007	2005 – 2008	2006 – 2009
Dr. Barrington Cross	Dr. Joel Coats	Dr. Barrington Cross
Dr. Judd Nelson, Alternate	Dr. Nancy Ragsdale, Alternate	

DIVISION COMMITTEES

FERT Program Committee

Mr. William Hall, **Chair**	(863) 428-7161		bill.hall@mosaicco.com

Nominating Committee

Dr. Allan Felsot, **Chair**	(509) 372-7365	FAX: (509) 372-7460	afelsot@tricity.wsu.edu
Dr. Rodney Bennett	(610) 878-6476	FAX: (610) 878-6475	rodney.bennett@cerexagri.com
Dr. Jeanette Van Emon	(702) 798-2154	FAX: (702) 798-2243	vanemon.jeanette@epa.gov

Awards Committee

Dr. James Seiber, **Chair**	(510) 559-5600		jseiber@pw.usda.gov

Members

Dr. John Casida	Dr. Robert Hollingworth	Dr. Willis Wheeler
Dr. Fritz Fuehr	Dr. Ralph Mumma	Dr. Izuru Yamamoto
Dr. Bruce Hammock	Dr. Nancy Ragsdale	
Dr. Ernest Hodgson	Dr. Jim Tumlinson	

Membership Committee

Dr. Randy Weintraub, **Co-Chair**	(610) 878-6472	FAX: (610) 878-6475	Randy.weintraub@cerexagri.com
Dr. Christopher Peterson, **Co-Chair**	(662) 338-3104	FAX: (662) 338-3101	cjpeterson@fs.fed.us

Publications Committee

Dr. Cathleen Hapeman, **Chair**	(301) 504-6451	FAX: (301) 504-5048	hapemanc@ba.ars.usda.gov
Members			
Dr. Rodney Bennett	Dr. Laura McConnell		Dr. Terry Spittler
Dr. John Clark	Dr. Judd Nelson		

Finance Committee

Dr. Barry Cross, **Chair**			bcross@weidel.com
Dr. Terry Spittler, **Ex Officio**	(814) 272-1039	FAX: (814) 272-1019	tds2@cornell.edu
Members			
Dr. Don Baker	Dr. Ralph Mumma		
Dr. Willa Garner	Dr. Willis Wheeler		

Hospitality Committee

Coffee Hour			
Dr. Terry Spittler	(315) 787-2283	FAX: (315) 787-2320	tds2@cornell.edu
Dr. Liliana Schwartz	(302) 451-5842	FAX: (302) 451-5943	Liliana.schwartz@usa.dupont.com
Social Hour			
Dr. Aldos Barefoot	(302) 451-5856	FAX: (302) 451-5941	aldos.c.barefoot@usa.dupont.com
Dr. Jeff Jenkins	(541) 737-5993	FAX: (541) 737-5001	Jeffrey.jenkins@orst.edu

SPECIAL COMMITTEES

Bylaws Committee

Dr. Don Baker, **Chair**	(925) 254-108		

Committee on Patron Relations

Dr. Luis Ruzo, **Chair**	(510) 741-3000	FAX: (510) 741-3030	l.ruzo@ptrlwest.com
Mr. Paul Giesler			

Future Special Conference Committee

Dr. John M. Clark, **Chair**	(413) 545-1052		
Dr. Robert Hollingworth			

Public Relations Committee

Dr. Jeff Jenkins, **Chair**	(541) 737-5993	FAX: (541) 737-5001	Jeffrey.jenkins@orst.edu
Members			
Dr. Ann Lemley	Dr. James Seiber		

Education Committee

Dr. John Johnston, **Chair**	(970) 266-6082	FAX: (970) 266-6089	John.J.Johnston@aphis.usda.gov
Dr. John Bourke, **Investment Coordinator**			
Dr. Allan S. Felsot, **Young Scientist Recognition Coordinator**	(509) 372-7365	FAX: (509) 372-7460	afelsot@tricity.wsu.edu
Members			
Dr. David Barnekow	Dr. J. Harold Falls		Dr. Judd O. Nelson
Dr. John M. Clark	Dr. Vincent Hebert		Dr. Jack R. Plimmer
Dr. Joel Coats	Dr. Ann Lemley		Dr. Nancy Ragsdale
Dr. Barry Cross	Dr. Glenn Miller		Dr. William Ridley

PROGRAM COMMITTEE LISTING

See page 34

DIVISION OF PESTICIDE CHEMISTRY/AGROCHEMICALS
PAST CHAIRS

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

AGRO MEMBERS OF THIRTY OR MORE YEARS

The Agrochemicals Division
Honors 92 members
with
Thirty or more years of service to the Division!

Roger Addor	36
Larry Ballantine	31
David Ballee	30
Donald Barringer	33
John Benzinger	35
Elliot Bergman	34
Gerald Berkelhammer	31
Morton Beroza	36
George Beusch	36
Leroy Bjerke	36
Harris Borman	36
Arnold Borsetti	30
John Bourke	35
Terry Burkoth	32
Virlyn Burse	35
Ronald Buxton	35
Nyal Camper	34
John Casida	36
Mikio Chiba	36
Claude Corty	34
Donald Crosby	36
John Davidson	35
Edgar Day	31
James Devine	34
Henry Dishburger	32
William Draper	30
Warren Duane	35
Aubry Dupuy	35
John Durden	36
William Durham	32
Walter Farmer	36
Hanspeter Fischer	31
D. R. Flint	33
William Fong	33
David Fredrickson	30
Richard Garnas	32
Anthony Gemma	36
Fred Gretch	32
Robert Hoagland	33
Ernest Hodgson	36
Robert Hollingworth	33
Philip Howard	31
David Hutson	30
John Hylin	34
Gerald Jacobsen	30
John Kieft	35
Ute Klingebiel	33
Robert Krieger	34
David Kurtz	36
John Leffingwell	34
Marguerite Leng	34
David MacLean	34
Gino Marco	34
Joe McDaniel	32
Francis McNamara	30
Julius Menn	36
Robert Menzer	36
David Merricks	30
Ralph Mumma	36
T. Nakatsugawa	30
Frank Norris	32
Delbert Oehler	35
Jack Plimmer	36
Richard Puhl	34
Donald Rainey	30
Robert Riley	30
Ronald Ross	36
Herbert Scher	34
Floyd Schnell	36
Robert Schroeder	36
James Seiber	34
Harish Sikka	34
James Singmaster	36
David Soderlund	30
E. Y. Spencer	36
Robert Stipanovic	32
Manabu Suzuki	33
Gerald Takei	33
Wayne Thornburg	36
James Tumlinson	30
Carlos van Peteghem	34
Akshay Vidyarthi	36
George Ware	33
Robert Wauchope	34
G. R. Webster	33
Willis Wheeler	36
Jerome Wiedmann	33
James Woodrow	30
Edward Woolner	35
David Wustner	33
Matthew Zabik	36
Richard Zepp	32

Thank you all for your dedication!

MINUTES FROM THE AGROCHEMICAL DIVISION COMBINED GOVERNANCE MEETING

231st ACS National Meeting – Atlanta, Georgia
Sunday, March 26, 2006, 5:00 – 10:05 pm
Don Wauchope – Chair

The Chair called the Governance Meeting to order at 5:00 pm and described the proposed agenda consisting of sequential meetings of the Long Range Planning Committee, Programming Committee, and the Executive Committee. Don explained that the Division's programming and planning functions needed additional effort from the Executive committee and membership, and his proposed agenda was intended to focus our efforts. Rod Bennett made a motion to accept the agenda; Laura McConnell seconded; and the motion passed. Don emphasized that the Division needs a written strategic plan and continued long range planning. He proposed to continue meetings of the Long Range Planning Committee as an integral part of Division Governance meetings.

LONG RANGE PLANNING COMMITTEE MEETING

Following the discussion of the agenda, the Committee then entertained proposals for Division activities that arose from the Strategic planning meeting in January, 2006.

Programming at one ACS national meeting each year

Al Barefoot and Joe Massey presented the results of the breakout session that prepared a plan for evaluating and proposing a change to programming at one meeting each year. They reviewed the rationale for the change, issues that should be addressed, risks to the Division, dissenting viewpoints and recommended that the Division focus its energies on one major technical meeting each year while providing, at other times, special meetings and workshops that would target specific audiences by topic or geographical location. The proposal would affect the presentation of the International Awards, and Al and Scott Jackson prepared a separate proposal on the award.

The committee discussed the proposal with suggestions to broaden the programming, supplement the current International award with a mid-career award, consider meetings of other professional societies when scheduling AGRO meetings, make allowance for the increased difficulty of networking and aspects of running the Division, and target regional meetings. We may need to plan meetings of the Executive Committee at other times to ensure the continued operation of Agro. The proposed change in meeting schedule has a trial period of 3 three years, which was supported by the committee members. Barry Cross informed us that the ACS is considering one council meeting each year, and Don noted that three divisions program at one ACS meeting each year. **Action:** The Long Range Planning Committee approved the following motion to present to the Executive Committee:

> *Beginning in 2008 and through 2010, schedule Agrochemicals Division meetings and programming at the Fall ACS National Meeting only. Schedule special programming, co-sponsor meetings with related societies, or participate in ACS regional and local meetings during the 3-year trial.*

Grant one International Award each year

Al Barefoot and Scott Jackson, representing DuPont and BASF, the sponsors of the International Awards proposed granting a single International Award each year. The two companies would cosponsor the award, increase the honorarium to $5000, and pay travel expenses of $2000. Each company will contribute half the total cost ($3500) to support the award. BASF and DuPont have agreed in principle. The proposal will be presented to the Executive Committee for vote.

Renaming the Division

Allan Felsot presented a proposal for changing the Division name.
Action: Rod Bennett suggested that we poll the membership on the need for a name change before the San Francisco meeting. Barry Cross seconded the motion, which passed. Allan will handle the poll. A name change committee will be appointed after the San Francisco meeting.

Internationalizing the Division

Rod Bennett and Jason Sandahl presented ideas for increasing Agro participation in international organizations and expanding interactions with scientists in other countries. The USDA Foreign Agricultural Service maintains lists of technical experts that are available for consultation and workshops and encourages scientific exchanges between US and foreign scientists. Agro could contribute names of members to the list. Jason described the Cochran

Fellowship and Borlaug fellowship that are given to train agricultural scientists from middle income and emerging market countries. Rod proposed a committee to encourage participation by Ag and Food and other Divisions within ACS.

AGRO involvement in INFOCRIS

Mark Ogzewalla and Peter Ampin presented a proposal for involvement in the FAO/IAEA support network for agricultural chemicals. Each chemical has an editor assigned to it, and AGRO could co-ordinate selection of editors. The meeting participants agreed that it would be worthwhile to participate and assist in finding editors.

PROGRAM PLANNING COMMITTEE

Laura McConnell presented a proposal to restructure the Programming Committee and create Long Range Programming Coordinators (LRPC). There would be two LRPCs who are appointed by the Division Chair and serve for 2 to 4 year over lapping terms. LRPCs will be keepers of programming ideas and plans and provide continuity in programming. The Programming Committee will work with the Chair Elect and LRPCs to organize symposia and alternative programming. Joe Massey agreed to serve as an LRPC. We need another volunteer to assist with a 3-year programming plan for the Division. The programming committee will host an open meeting at National Meetings and develop a training program for symposium organizers. Jim Seiber suggested inviting members of other Divisions to participate in the programming committee; Ken Racke and John Johnston agreed to begin a workshop program to increase the diversity of programming beginning in 2008 with the change in Division meeting schedule. Ideas for workshops included involving IR-4 for residue programs, training for international audience, and topics of concern to regulatory agencies. Allan Felsot proposed a student-organized symposium. The Committee agreed that a student group should be added to the programming committee. Allan proposed a Division sponsored lunch for students at the San Francisco meeting for the purpose of organizing a programming committee. Don Wauchope seconded the motion, which passed.
Rod Bennett agreed to investigate webcasting for 2007 events.

Atlanta update

The program includes the International Award Symposium (sponsored by DuPont Crop Protection) in honor of Joel Coats, a symposium on Advances in Environmental Fate, a general paper session, a symposium on Plant Responses to Biotic Insults, a general poster session, and the Young Scientist Award Symposium.

San Francisco Program – 232nd ACS National Meeting - Laura McConnell

The program for the meeting consists of the International Award for Research in Agrochemicals: Symposium in Honor of Isamu Yamaguchi: Fungicides; John Clark, Organizer. The award will be sponsored by BASF. The Sterling Hendricks Memorial Lecture will be given by Stanley Brewster and sponsored by Division of Agricultural & Food Chemistry. Another six symposia are planned:

Agricultural Impacts on Air Quality
Agrochemical Education Awards For Graduate Student Travel: Research Poster Presentations
Agrochemical Residue & Metabolism Chemistry
Alternatives to the use of methyl bromide in pre-plant soil fumigation and stored commodities
Characterizing natural products as pesticides, repellents, or biomarkers
Recent Advances in Immunochemistry and Their Applications to Agrochemicals
Special Programming

Pan Pacific - 2008

We contracted with the ACS Office of Congress Management and Vendor Relations to handle logistics for the conference, which will be held June 1-4, 2008 at the Waikiki Marriott in Honolulu. The Pesticide Science Society of Japan has agreed to co-sponsor the conference and named Dr. Koichi Yoneyama as the co-organizer for the conference. Plans are in development for both organization and programming.

SERMACS Regional Meeting, November 1 – 4, 2006, Augusta, Georgia

Laura presented a proposal form the Savannah River Section for AGRO support of the meeting. Action: After discussion of the proposal, Al Barefoot proposed that AGRO contribute up to $1000 to support programming for the session on agrochemicals. Rod Bennett seconded the motion, which passed. The check should be payable to SERMACS.

2006 IUPAC International Pesticide Congress

Ken Umetsu from the Pesticide Science Society of Japan gave an update on the Congress. The poster deadline was extended to April 15. Posters must stay up for all four days. The program is on the web page. The 2006 Congress will be held in Kobe and has been organized into topics in three areas with workshops, poster sessions and an exhibition. Further information can be found at http://www.iupac2006.jtbcom.co.jp/. Ken recommended the ferry from Kansai to Kobe.

2010 IUPAC International Pesticide Congress

The Agrochemicals Division was unsuccessful in its bid for the 2010 conference, which will be held in Melbourne.

The LRPC and Program Committees recessed for a light supper. The meeting resumed at 8:15 pm.

EXECUTIVE COMMITTEE

Update from the Chair

Don Wauchope summarized the results of the Strategic Planning Conference and pointed out the new structure for the Division meeting. The Long Range Planning Committee and Program Planning Committee met at 5:00 pm and 6:00 pm, respectively. Don commented that approval of the proposals required a vote of the Executive Committee, and a quorum of the Executive Committee is not defined in the By-Laws. A quorum is defined for a meeting of the Division (15 members). Approval of proposals from the Strategic Planning Meeting does not appear to require a vote of the membership.

Secretary's Report – Aldos Barefoot

The Executive Committee agreed to dispense with the reading of the minutes of the last meeting.

Treasurer's Report – Terry Spittler

Terry provided a financial statement for 2005. Total operating income was $119, 230 while expenses were $96,894. Total assets remained approximately the same as 2004 with a total of $671,285 in various accounts.

Thematic Programming

David Lohse presented a program from DAC on thematic programming. The intent is to allow focused and accessible programming on high interest topics that cut across Division areas of interest. Themes for Chicago are "Chemistry for a Sustainable Energy Future", "Chemistry for a Sustainable Food Supply", and "Chemistry for a Sustainable Future Water Supply". Benefits include central location for programs, joint programs with other Divisions, financial support and venue that will highlight programming of the Division. **Action:** Rod Bennett moved that AGRO take a lead role in organizing thematic programming for the Chicago meeting. Allan Felsot seconded the motion. During discussion, Jim Seiber agreed to work on the programming. The motion passed.

Fertilizer Subdivision Report – Bill Hall, Wayne Robarge

FERT is inactive. There is not enough interest from industry or support to continue the level of activity that Bill and Wayne have pursued for the past 2-3 years. There are no officers. The Division will retain the FERT subdivision on the membership list, and we will continue to program fertilizer related activities, as there is interest.

Councilor's Report – Joel Coats, Barry Cross

Dr. Nalley announced that in 2006 her presidential theme will be "Ensuring the Future". At Atlanta the meeting will address: "Enabling Innovation" and at the fall meeting in San Francisco the theme will revolve round "Collaborations". She plans to set up advisory groups in three areas: the public image of chemists, recognition of volunteer service, and the involvement of high school teachers in the ACS. It should be noted that CAS had another record year and that the vast majority of ACS member services are supported by net contributions from CAS and Publications Division. Membership in the ACS rose by 294. The attendance at the ACS meeting in Washington was 13,030, and the fee for ACS meeting registration in 2006 was raised to $305. The AGRO Division's decision, spearheaded by chair Don Wauchope, to develop and then implement a new strategic plan at a two and a half day Long Range Planning Conference in January in 2006 was perhaps the most noteworthy of all 2005 accomplishments. Members can look forward to a complete re-invention of the ACS web presence.

Membership Committee

Chris Peterson presented the trends in membership. AGRO membership losses were lower than in several previous years. Chris noted that most members who leave AGRO also leave ACS. At the end of 2005, AGRO had 1083 members; FERT 201. These numbers show a decline of about 30% from year 2000 membership levels.

Publications Committee – Laura McConnell

PICOGRAM for the Spring 2006 ACS meeting was mailed to AGRO members last week February – first week of March. It is also posted on the web. Full page paid ads in this issue of PICOGRAM increased by one to 7 and (Critical Path converted from a half-page to full page). A new half page was added (Residues, Inc.). No ad for Oxford was included because our contact has left Oxford. Several attempts (email, voice mail) were made to contact Oxford concerning their free ad but no response was received. The editor requests that individuals who need/want to contribute to the PICOGRAM do so in a more timely fashion. Due date for Fall issue is May 15 for ads and June 1 for everything else. A reminder will be sent via AG-LIST. Rodney Bennett has been hawking our books at meetings; a brief summary is on p. 39 in the PICOGRAM. The editor is considering adding a new section Transitions or Notable Events. Feedback on what to include is welcome.

Website – Allan Felsot

Allan updated the website in time for the meeting. He has included highlights of past meetings and resources for agrochemicals.

E-mail Communications System – Tim Ballard, Terry Spittler

Tim reviewed the guidelines for posting items of general interest and asked for opinions on job postings since he had received requests. There was consensus that job postings would not be distributed by email. We will create a link from our website to the ACS on-line job postings.

Awards Committee – Jim Seiber
DuPont will sponsor the International Award for Joel Coats at this meeting. BASF will sponsor the award for Isamu Yamaguchi at the Fall meeting. The award committee agreed that a single award each year would be acceptable. They suggested consideration of a mid-career award to supplement the student awards and International Award. To follow up on an action from the last meeting, Al noted that Judd Nelson was the last Fellow elected. He was granted the award in 2003. Jim announced that Terry Spittler was elected a Fellow of the Division this year.
Action: Al Barefoot presented a motion for sponsorship of one International Award by DuPont and BASF (see above). John Johnston seconded the motion. The motion passed without opposition.

Finance Committee – Barry Cross
The Finance and Education committees examined the amount of support needed for current programs and agreed that a 5% removal rate would allow us to withdraw $20,000 each year from the Education Fund.
Action: Allan Felsot moved that the Young Scientist and Graduate Student award programs be funded at $10,000 each year or amounts greater than $20,000 total but less than 5% from the Education Fund. The motion was amended to require that proposed expenditures should be subject to audit by the Finance Committee. The motion passed.

Hospitality Committee – Liliana Schwartz, Terry Spittler
Eleven companies supported the coffee lounge for this meeting. Please take note of the sponsors listed on the board at the AGRO desk and thank them for their contributions. Other supporters have committed to a contribution, so please check the AGRO desk for updates. AGRO and AGFD will hold a joint Social Hour on Tuesday, 6 – 8 pm at the Westin.

Nominating Committee – Rodney Bennett (2006)
The tellers committee chair, Rod Bennett, reported that 190 ballots were returned.
The following people were elected to office:
Vice-Chair: John Johnston
Councilor: Barrington Cross
Members-at-Large of the Executive Committee (Term 2006-2008):
Todd Anderson, Cathleen Hapeman, Patricia Rice, Luis Ruzo, Jeanette Van Emon
Secretary: Aldos Barefoot
Treasurer: Terry Spittler

Patron Relations
Luis Ruzo noted that contributions come in late in the year. He asked to be replaced.

Education Committee – John Johnston
Young Scientist Research Award:
There were 15 entries for the Young Scientist Award. Dow AgroSciences continues to sponsor the award. The First place award winner was Perihan Kurt-Karakas (research under supervision of Terry Bidleman, Canada Environment). The runner-ups were Kelsey Prihoda (Joel Coats, advisor, Iowa State University) and Sup Yoon (John Marshall, advisor, Univ. Mass.) The next Graduate Student Research Poster Competition is scheduled for the Fall meeting in San Francisco. The next Young Scientists Research Award will be presented at the 2007 meeting in Chicago. Applications should be sent to Allan Felsot.

By-Laws Committee
Don Baker was unable to attend the meeting. Don Wauchope noted that several items for the By-Laws should be put on the agenda for discussion at the San Francisco meeting.

Long Range Planning Committee
The committee presented its proposals for vote of the Executive Committee.

Action: Al Barefoot presented the motion for programming at one ACS National Meeting each year. Allan Felsot seconded the motion. Don noted that there were 12 members of the Executive Committee present and proposed to solicit votes by mail or email from other members of the committee. Of those present in the room, 8 voted in favor of the motion, 4 against. Don will poll other members of the Executive Committee.

Action: In the absence of a specific proposal on a name change for the Division, Don empowered Allan Felsot to investigate interest in a name change and report at the San Francisco meeting.

Action: Laura McConnell proposed formation of a committee to work on increasing interactions with international organizations and non-US scientists. Rod Bennett seconded the motion. The motion passed.

Action: Laura McConnell presented the proposal for re-organizing the Program Committee. Rod Bennett seconded the motion. The motion carried.

Action: Rod Bennett moved to support AGRO involvement in INFOCRIS. Laura McConnell seconded the motion. The motion carried.

Cathleen Hapeman, Allan Felsot, and Tim Ballard were commended for significant upgrades in communications. Don was complimented for a successful Strategic Planning meeting.

Respectfully submitted,
Aldos C. Barefoot, Secretary

2005 TREASURER'S REPORT

Terry D Spittler – Treasurer
ATLANTA SUMMARY

OPERATING INCOME	
CONTRIBUTION INCOME	$ 30,475
PUBLICATIONS INCOME	7,428
DUES AND ASSESSMENT INCOME	22,810
OTHER INCOME *	58,517
TOTAL OPERATING INCOME	**$ 119,230**
OPERATING EXPENSES	
GRANTS, AWARDS AND DONATIONS	13,206
NATIONAL MEETING EXPENSES	52,922
INVESTMENT EXPENSES	45
PUBLICATION EXPENSES	14,803
CONFERENCES & WORKSHOPS	4,750
ADMINISTRATIVE EXPENSES	11,168
TOTAL OPERATING EXPENSES	**$ 96,894**
GAIN (LOSS) OPERATING ACCOUNT	**$ 22,336**

* $15,000 transferred from TRP to Operating Account
$42,000 transferred from JPM to Operating Account

	2004	**2005**
ASSETS		
CHECKING	$ 2,472	$ 22,493
T. ROWE PRICE	201,533	190,082
ACS INVESTMENT POOL	20,632	22.606
JP MORGAN CHASE	444,302	436,102
TOTAL ASSETS	**669,039**	**671,285**

*BYLAWS OF THE DIVISION OF AGROCHEMICALS
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 date 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, and the Chairs, the Chairs-Elect, Councilors and Alternate Councilors, 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, Division Councilors and Alternate Councilors, shall be elected by mail ballot as described elsewhere in these bylaws.

***Effective**

Approved, as amended, by the Committee on Constitution and Bylaws, acting for the Council of the American Chemical Society.

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 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 officers, 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 and 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 will 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 Division 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 the 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.

PROGRAM

American Chemical Society
DIVISION OF AGROCHEMICALS

232nd ACS National Meeting
San Francisco, California, September 10 – 14, 2006
L. L. McConnell, *Program Chair*

SOCIAL EVENTS:

International Award Banquet
Mon 6:00 – 9:00 pm
Reservations required; see page 14

Social Hour
Tue 6:00 – 8:00 pm
Marriott - The Club Room
See invitation on page 5

DIVISION MEETINGS:

AGRO Business Meeting
Sun 5:00 – 10:00 pm

AGRO Programming Discussion and Symposium Organizer Training
Wed 5:00 – 6:00 pm
Marriott, Salon 4/5
Details on page 5, 32 – 33

SUNDAY MORNING

Section A: Marriott -- Salon 1

Agrochemical Residue & Metabolism Chemistry
T. A. Wehner, J. J. Johnston, and D. J. Smith, *Organizers, Presiding*

8:30 — Introductory Remarks.

8:35 —1. HPLC/MS determination of azinphos-methyl metabolite degradation in apples**.** **A. H. Ackerman**, K. A. Anderson

8:55 —2. DNA adducts as biomarkers for pesticide oxidative stress and genotoxicity. **D. W. Boerth**, E. Eder, T. Andrade, J. Wetherbee, R. Mauro

9:15 —3. Chloropyridinyl neonicotinoid insecticides: Diverse molecular substituents contribute to facile metabolism in mice. **K. A. Ford**, J. E. Casida

9:35 —4. Risk assessment of groundwater contamination by imidacloprid leaching in different types of soils. **T. Jindal**
9:55 — Intermission.

10:10 —5. Analysis of manure-derived oxytetracycline in amended soil. Q. Wang, **S. R. Yates**

10:30 —6. Excretion of ^{14}C-α-chloralose from mallard ducks following a single, oral dose. **D. A. Goldade,** R. S. Stahl, J. J. Johnston

10:50 —7. Transformation of two chlorinated fumigants by hydrogen sulfide species. **W. Zheng,** S. R. Yates

11:10 —8. Development of an analytical method to quantify and identify multiple pesticides, antibiotics, and other residues in honey. **S. J. Lehotay,** A. R. Lightfield, K. Mastovska, H. Z. Senyuva

Section B: Marriott -- Salon 2

Alternatives to the Use of Methyl Bromide in Pre-plant Soil Fumigation and Stored Commodities: Overview, Economics, Trends, and Chemical Alternatives
R. M. Bennett, *Organizer*
L. Ruzo, *Organizer, Presiding*

8:00 — Introductory Remarks.

8:15 —9. Overview of agricultural fumigation: Past, present, and future. **S. R. Yates**

8:35 —10. Economic feasibility of methyl bromide alternatives. **J. D. Schaub**

8:55 —11. Ten years of field development of alternative soil fumigants: Lessons learned. **F. V. Sances**

9:15 —12. Fumigant use trends in California: Response to the methyl bromide phaseout. **T. J. Trout**

9:35 —13. Complexities of the registration process for the six main agricultural fumigants with particular reference to metam sodium and MITC. **I. S. Chart**

9:55 — Intermission.

10:10 —14. Dimethyldisulfide: A new soil fumigant. **R. M. Bennett,** R. S. Freedlander, P. Reibach

10:30 —15. Sodium azide-based pesticides. **D. J. Richards**

10:50 —16. Blockers of anion transporters as nematicidal alternatives to methyl bromide. **J. R. Bloomquist**, D. R. Boina

11:10 —17. Implementation of transitional strategies to replace methyl bromide in Florida. **J. W. Noling**

11:30 — Concluding Remarks.

SUNDAY AFTERNOON

Section A: Marriott -- Salon 1

Agrochemical Residue & Metabolism Chemistry

T. A. Wehner, D. J. Smith, and J. J. Johnston, *Organizers, Presiding*

1:00 — Introductory Remarks.

1:05 —18. Determination of brodifacoum in Palmyra Atoll land crab tissue. **T. M. Primus,** S. F. Graves, J. J. Johnston, G. Howald, C. Swift, J. D. Eisemann

1:25 —19. Sample preparation for determination of contaminates in foods and grains using Accelerated Solvent Extraction (ASE®). **S. E. Henderson**, B. E. Richter, R. E. Carlson, E. S. Francis, B. J. Murphy, R. J. Joyce

1:45 —20. Reverse phase high performance chromatography method for the detection of rifampin in bovine plasma. **R. S. Stahl**, J. L. Pilon, L. A. Miller, J. C. Rhyan

2:05 —21. Tissue distribution, elimination, and metabolism of sodium ^{36}Cl-perchlorate in lactating goats. **D. J. Smith, H. Hakk, G. L. Larsen**

2:25 — Intermission.

2:40 —22. Metabolism and residue depletion of ^{3}H-ivermectin in the muscle tissue of rainbow trout after oral administration. **B. Shaikh**, N. Rummel, C. Gieseker, R. Reimschuessel

3:00 —23. Aromatics catabolism and protein regulation in *Mycobacterium sp.* JS14. **Q. X. Li**, S.-E. Lee, J.-S. Seo, Y.-S. Keum

3:20 —24. Antimicrobials and antibiotics: SPE considerations for UPLC-MS analysis. **M. S. Young**, K. Tran, M. Benvenuti

3:40 —25. P450-mediated metabolism of tribufos defoliant and EPTC herbicide: Identification of glutathione conjugates by liquid chromatography-electrospray ionization mass spectrometry. **K. Fujioka**, G. B. Quistad, J. E. Casida

4:00 —26. Effect of dose on residues and disposition of an experimental ^{36}Cl-chlorate product in broilers. **D. J. Smith**, A. Byrd, R. C. Anderson

4:20 — Concluding Remarks.

Section B: Marriott -- Salon 2

Alternatives to the Use of Methyl Bromide in Pre-plant Soil Fumigation and Stored Commodities: Chemical Alternatives, Flux, Modeling, and Risk Assessment

L. Ruzo, *Organizer*
R. M. Bennett, *Organizer, Presiding*

1:00 — Introductory Remarks..

1:05 —27. Nematode control and characteristics of fosthiazate, a methyl bromide alternative. **G. A. Leyes**

1:25 —28. Comparison of chloropicrin response thresholds with treatment levels shows low likelihood of adverse effects. **J. H. Butala**

1:45 —29. Propylene oxide as an alternative to methyl bromide for strawberry fumigation. **M. W. Brooks**

2:05 —30. Nematicidal activity of free fatty acids and furfural metabolites. **F. H. Abdel Rahman**, S. Clark, B. Woodard, M. A. Saleh

2:25 — Intermission.

2:40 —31. Methyl bromide alternatives for forest tree nurseries. **D. Wang**, J. Juzwik, S. Fraedrich

3:00 —32. A probabilistic model for estimating bystander inhalation risks following fumigant applications. **R. Reiss Jr.**

3:20 —33. Recent refinements in the fumigant emissions model (FEMS). **D. A. Sullivan**

3:40 — Concluding Remarks.

MONDAY MORNING

Section A: Marriott -- Salon 1

ACS International Award for Research in Agrochemicals: Symposium in Honor of Isamu Yamaguchi: Fungicides

Sponsored by BASF Corporation
J. M. Clark, *Organizer, Presiding*

8:00 — Introductory Remarks and Award Presentation.

8:15 —34. Award Address: Fungicide biochemistry and molecular biology: Past, present and future. **I. Yamaguchi**

8:45 —35. *Fusarium* head blight in cereal crops: Biotechnological approaches for prevention of mycotoxin contamination. **M. Kimura**, T. Tokai, N. Ochiai, N. Takahashi-Ando

9:15 —36. Studies on disease responses in rice plants by plant defense activators. K. Umemura

9:45 — Intermission.

10:15 —37. Foliar application of a plant activator could be an alternative to soil fumigation for control of soilborne plant pathogens. **T. Arie**, R. Ishikawa, H. Nakashita, I. Yamaguchi, T. Teraoka

10:45 —38. Function of brassinosteroids in plant diseases. **S. Yoshida**

11:15 —39. Role of two-component histidine kinases in stress response and fungicide resistance in filamentous fungi. **M. Fujimura**

Section B: Marriott -- Salon 2

Alternatives to the Use of Methyl Bromide in Pre-plant Soil Fumigation and Stored Commodities: Flux, Modeling, Risk Assessment, and Toxicological Considerations

L. Ruzo and R. M. Bennett, *Organizers*
J. H. Kinzell, *Presiding*

8:30 — Introductory Remarks.

8:40 —40. Derivation of human toxicity reference values for methyl iodide using physiologically based pharmacokinetic (PBPK) modeling. L. M. Sweeney, C. R. Kirman, M. L. Gargas, **J. H. Kinzell**

9:00 —41. CALPUFF modeling of fumigation applications: Advancing the state-of-the-art in computing buffer zones. **D. A. Sullivan**

9:20 —42. Methyl iodide and methyl bromide as soil fumigants: Toxicology and worker exposure. **D. W. Gammon**, C. N. Aldous, R. C. Cochran

9:40 —43. Fumigant buffer zone development studies: Fourteen years of progress. **T. A. Barry**, B. R. Johnson, R. Segawa

10:00 — Intermission.

10:15 —44. Quantification of iodomethane in air samples from worker exposure and environmental monitoring/flux studies following application to plots via shank injection or drip irrigation. **F. C. Baker,** L. C. Mézin, J. L. Platt Jr.

10:35 —45. Reducing fumigant emissions using surface tarps: Field and laboratory assessments. **S. Papiernik,** S. R. Yates, J. Gan, R. Dungan, S. M. Lesch, W. Zheng, M. Guo

10:55 —46. Risk trade-off between methyl bromide and alternative chemicals, and techniques for reducing emissions in Japan. **Y. Kobara**

11:15 — Concluding Remarks.

Section C: Marriott -- Salon 3

Synthetic Pyrethroids and Surface Water Quality: Occurrence and Environmental Fate

F. Spurlock and P. Hendley, *Organizers*
J. Gan, *Organizer, Presiding*

8:30 — Introductory Remarks.

8:40 —47. Synthetic pyrethroids and California surface water. **F. Spurlock**

9:00 —48. Ecological risk characterization for the pyrethroid insecticides. **R. D. Parker,** M. T. Shamim

9:20 —49. Overview of pyrethroids in California surface waters: Presence, toxicity and relationships to land use. **D. P. Weston**

9:40 —50. Synthetic pyrethroids: Exposure, effects and risk mitigation. **R. Schulz**

10:00 — Intermission.

10:20 —51. Pyrethroid pesticide fate and transport: An overview of key data and conceptual models describing behavior. **P. Hendley**, J. S. Warinton, N. Poletika, M. G. Dobbs

10:40 —52. Sediment-bound pyrethroid analysis and isomerization. **T. L. Fojut,** T. Young

11:00 —53. Phase distribution and persistence of pyrethroids in sediments. **J. Gan,** S. Bondarenko, F. Spurlock

MONDAY AFTERNOON

Section A: Marriott -- Salon 1

ACS International Award for Research in Agrochemicals: Symposium in Honor of Isamu Yamaguchi: Fungicides

Sponsored by BASF Corporation
F. Matsumura, *Presiding*
J. M. Clark, *Organizer, Presiding*

1:30 —54. Ethaboxam and its biological characteristics. **D.-S. Kim**

2:00 —55. Orysastrobin: A fungicide innovation for rice. **G. Stammler**, A. Watanabe, I. Hino, U. Schoefl, E. Haden

2:30 —56. Natural product fungicides and their congeners as pharmaceuticals. **S. J. Cutler**

3:00 — Intermission.

3:15 —57. Chemical control of plant diseases in China. **M.-G. Zhou**

3:45 —58. Recreational exposure to chlorothalonil following application to turfgrass. **J. M. Clark**

4:15 —59. Endocrine disrupting actions of pesticides: Approaches to assess their estrogenic actions using cell models. **F. Matsumura**

Section B: Marriott -- Salon 2

Alternatives to the Use of Methyl Bromide in Pre-plant Soil Fumigation and Stored Commodities: Flux, Risk Assessment, and Alternative Processes

L. Ruzo and R. M. Bennett, *Organizers*
S. R. Yates, *Presiding*

1:30 — Introductory Remarks.

1:40 —60. Options to estimate emission rates: When to rely on ambient-based emissions and when to use on-field FLUX methods. **D. A. Sullivan**

2:00 —61. Seed-delivered disease protection. **J. O. Becker**

2:20 —62. Current situation of alternative technologies to methyl bromide for pre-plant soil fumigation in Japan. **A. Tateya**

2:40 —63. Organic strawberry production in California. **F. V. Sances**

3:00 — Intermission.

3:15 —64. Progress on alternatives to methyl bromide in China. **A. Cao II**, X. Duan, H. Yuan, M. Guo, W. Zhang

3:35 —65. Sand, calcium, and high soil pH: A high-risk recipe for enhanced biodegradation. **J. N. Matthiessen**, B. Warton

3:55 —66. Innovative approaches for soil fumigation. **D. O. Chellemi**, J. Mirusso

4:15 —67. Heat treatment as an alternative to methyl bromide space fumigation in food-processing facilities for controlling insects: Confused flour beetle, *Tribolium confusum* (Jacquelin du Val). **D. R. Boina**, B. Subramanyam, A. Sajid

4:35 — Panel Discussion.

4:50 — Concluding Remarks.

Section C: Marriott -- Salon 3

Synthetic Pyrethroids and Surface Water Quality: Chemistry and Ecotoxicology
J. Gan and F. Spurlock, *Organizers*
P. Hendley, *Organizer, Presiding*

1:30 —68. Occurrence of pyrethroids in bed and suspended sediments in California. **M. L. Hladik**, K. L. Smalling, J. L. Orlando, K. Kuivila

1:50 —69. Analysis of pyrethroid pesticides in sediment and waters at part per trillion levels by modified EPA method 8270 GC/MS narrow-range scan selected ion monitoring. R. L. Heines, **P. W. Halpin**

2:10 —70. Bioavailability of pyrethroids in surface water and sediment. **W. Hunter**, W. Yang, J. Gan, S. Bondarenko, F. Spurlock

2:30 —71. Chemical approach for assessing bioavailability of pyrethroid insecticides in sediments. **M. J. Lydy**, J. You

2:50 — Intermission.

3:10 —72. Fate and effects of λ-cyhalothrin observed in ditch microcosms system of different trophic status and seasonality. **P. J. Van Den Brink**, M. Leistra, I. Roessink, R. P. A. Van Wijngaarden, T. C. M. Brock, S. J. Maund

3:30 —73. Assessing the toxicity of synthetic pyrethroids to aquatic sediment dwellers. **J. S. Warinton**, M. G. Dobbs, J. M. Giddings

3:50 —74. Patterns of pyrethroid contamination and toxicity in agricultural and urban stream segments. **C. Ng**, D. P. Weston

4:10 —75. Recent advances in sediment toxicity identification evaluations emphasizing pyrethroid pesticides. **B. S. Anderson**, B. M. Phillips, J. W. Hunt, S. Clark, J. Voorhees, A. Mekebri, R. S. Tjeerdema

MONDAY EVENING

Section A: Moscone Convention Center -- Hall D

Sci-Mix
L. L. McConnell, *Organizer*

8:00 - 10:00 pm
See subsequent listings:
112, 116, 129-142, 146, 155, 161-162

TUESDAY MORNING

Section A: Marriott -- Salon 1

The Future Role of Pesticides in Agriculture
S. J. Lehotay and L. L. McConnell, *Organizers, Presiding*

8:30 — Introductory Remarks.

8:45 —76. Evolution of pesticide use and regulation in agriculture. **J. N. Seiber**

9:15 —77. Importance of pesticides in crop production for the foreseeable future. **L. P. Gianessi**, N. Reigner

9:45 —78. IPM as a strategy for sustaining pesticide technology as a viable tool. **A. S. Felsot**

10:15 — Intermission.

10:30 —79. Challenges in pesticide management in Mali. **H. K. Traore**

11:00 —80. Trends in the use of pesticides in China. **Z. Ye**, Y. Zheng, Y. Yang, G. Liang

11:30 —81. Pesticide issues in Latin America. **E. Carazo**

Section B: Marriott -- Salon 2

Agricultural Impacts on Air Quality

L. L. McConnell, C. J. Hapeman, J. N. Seiber, and O. Hertel, *Organizers*
M. S. Majewski, *Organizer, Presiding*

8:30 — Introductory Remarks.

8:35 —82. Emerging issues in agricultural air quality: Challenges for the agrochemical research community. **V. Aneja**

9:00 —83. Pesticide VOC emissions as an agricultural air quality concern: Predicting emissions to the atmosphere. **S. R. Yates**

9:25 —84. Regulation of ammonia from agriculture in Denmark: Concept and methodology. **O. Hertel**, C. Geels, P. Løfstrøm, L. M. Frohn, C. A. Skjøth, J. L. Bak, S. Gyldenkærne, M. Hvidberg, P. V. Madsen, L. Moseholm

9:50 —85. Relative humidity and its effect on sampling and analysis of agricultural odorants in air. **S. L. Trabue**

10:15 — Intermission.

10:30 —86. 2005 MITC residential air assessment in Franklin County, Washington. **V. Hebert**, J. Merriman, J. LePage

10:55 —87. Airborne pesticide drift and community monitoring. **S. E. Kegley**, K. T. Mills

11:20 — Panel Discussion. Balancing producer, regulatory, and community concerns.

Section C: Marriott -- Salon 3

Synthetic Pyrethroids and Surface Water Quality: Mitigation and Stewardship

P. Hendley, J. Gan, and F. Spurlock, *Organizers, Presiding*

8:30 —88. Mitigation practices to reduce the impacts of synthetic pyrethroids in urban and agricultural watersheds. **D. L. Haver**, L. Oki, J. Gan, J. N. Kabashima

8:50 —89. Benefits of vegetated agricultural drainage ditches as a best management practice (BMP) in Yolo County, California. **D. L. Denton**, J. Wrysinski, M. T. Moore, C. M. Cooper, P. Robins

9:10 —90. Development of a simulation model to evaluate, design, and implement vegetated agricultural drainage ditches as a best management practice (BMP). **W. M. Williams**, J. R. Trask, J. Wrysinski, D. L. Denton

9:30 —91. Pesticide loading analysis for the Sacramento River watershed. **S. Dasgupta,** J. M. Cheplick, D. L. Denton, J. Troyan, W. M. Williams

9:50 — Intermission.

10:10 —92. Mitigation and stewardship of synthetic pyrethroid insecticides for sediment quality. **N. Poletika**, R. Jones

10:30 — Discussion.

TUESDAY AFTERNOON

Section A: Marriott -- Salon 1

The Future Role of Pesticides in Agriculture

L. L. McConnell and S. J. Lehotay, *Organizers, Presiding*

1:00 —93. Responding to the changing pesticide landscape: Evolution or intelligent design. **B. C. Gerwick III**

1:30 —94. Applications of green chemistry to crop protection. **P. Marrone**

2:00 —95. Sustainable and safe use of agrochemicals: Can we do better? **T. W. Schillhorn van Veen**

2:30 — Intermission.

2:45 —96. Insecticide discovery in the "post-genomic" era. **D. Soderlund**

3:15 —97. Barriers to better agricultural practices with regard to pest control. **K. K. Curry**

3:45 —98. Global trends in pesticide regulation: Some proposed approaches to international harmonization. **D. Wauchope**

4:15 — Discussion.

Section B: Marriott -- Salon 2

Agricultural Impacts on Air Quality

L. L. McConnell, J. N. Seiber, M. S. Majewski, and O. Hertel, *Organizers*
C. J. Hapeman, *Organizer, Presiding*

1:30 —99. California's toxic air contaminant program for pesticides. **L. Baker**, R. T. Segawa

1:55 —100. Volatile organic compounds and greenhouse gas emissions from California dairies. **F. M. Mitloehner**

2:20 —101. Linking ammonia emission reduction and air concentrations and depositions of reduced nitrogen in Europe. **A. Bleeker**, M. A. Sutton

2:45 — Intermission.

3:00 —102. Modeling ammonia with high resolution in regional scale air pollution models. **C. A. Skjøth**, S. Gyldenkærne, O. Hertel, J. Christensen, T. Ellermann, L. M. Frohn, C. Geels, J. Brandt, K. M. Hansen

3:25 —103. Atmospheric transport and deposition of pesticides in Sweden. **J. Kreuger**, H. Kylin

3:50 —104. Atmospheric levels of current-use pesticides in western Canada. **R. Bailey**, P. Hall

Section C: Marriott -- Salon 3

Weed Resistance to Herbicides: Modes of Action and Mechanisms of Resistance

Cosponsored with Monsanto Corporation
W. P. Ridley, R. D. Sammons, and A. S. Felsot, *Organizers, Presiding*

1:30 —105. Weed resistance to herbicides in North America: Herbicide classification. **C. A. Mallory-Smith**

2:00 —106. Unique resistance mechanisms and challenges: Examples from waterhemp. **P. J. Tranel**

2:30 —107. Mechanisms of weed resistance to inhibitors of acetyl-CoA carboxylase. **M. J. Christoffers**, A. V. Kandikonda

3:00 — Intermission.

3:15 —108. Target site resistance to photosystem II inhibitors in weeds. **F. J. Tardif**

3:45 —109. Evolution of resistance to phytoene desaturase-inhibiting herbicides. **F. E. Dayan**, B. Scheffler, R. S. Arias, A. Michel, M. D. Netherland

DIVISION OF AGROCHEMICALS
POSTER SESSIONS

TUESDAY AFTERNOON
1:00 – 5:00 pm
Moscone Convention Center -- Hall D

Section D: New Developments in Agrochemical Research General Posters

L. L. McConnell, *Organizer*

110. Fate and transport modeling of the potential influence of rice agriculture potential on aquaculture. **A. M. Ritter**, W. M. Williams, C. R. Leake

111. Characterization of carbendazim-resistant strains of *Fusarium graminearum* (wheat scab) in China. **M.-G. Zhou**, C.-J. Chen, J.-X. Wang

112. 2005 MITC near-field air assessment; Franklin County, Washington. **J. Merriman**, V. Hebert

113. Atrazine-induced hypoxic stress and regulation of hemoglobin genes in larvae of the aquatic midge *Chironomus tentans* (Diptera: Chironomidae). **T. D. Anderson**, Y. Jin-Clark, K. Begum, K. Y. Zhu

114. Soil organic amendment as affecting herbicide fate. **M. A. Cabrera**, L. Cox, W. C. Koskinen

115. Use of the REMM to assess the effectiveness of buffer zones around agricultural fields to control offsite movement of a high K_{oc} pesticide. **T. Estes**, R. C. Everich

116. Analysis of adducts from reactions of herbicides with DNA bases. **T. Andrade**, D. W. Boerth, R. Mauro, J. Wetherbee

117. Low-cost methods for reducing 1,3-dichloropropene volatilization from agricultural soil. **D. Ashworth**, S. Yates

118. Human exposure to surface pesticide residues: Dislodgeable foliar residues and pilot studies to predict bioavailability. **Y. Li**, J. J. Keenan, H. Vega, R. I. Krieger

119. Potential pine seed cone harvester pesticide exposures are probably not determined by dislodgeable foliar residues. **R. I. Krieger**, J. J. Keenan, Y. Li, T. Dinoff, H. Vega

120. Chemical surface residues: Critical determinants of occupational and residential human pesticide exposure. **R. I. Krieger**, J. J. Keenan, Y. Li, H. Vega

121. Persistence of pyrazosulfuron-ethyl and halosulfuron-methyl in aqueous solutions: Comparing hydrolytic dissipation. **W. Zheng**, S. R. Yates

122. Gossypol recovery and utilization from cottonseed. **M. S. Kuk**, R. Tetlow

123. Glyphosate metabolism in glyphosate-resistant and susceptible soybean and canola. **V. K. Nandula**, K. N. Reddy, A. M. Rimando, S. O. Duke, D. H. Poston

124. Enzyme profiles in response to polycyclic aromatic hydrocarbons in *Burkholderia sp.* C3. **Y. Hu**, I. K. Cho, S -E. Lee, J -S. Seo, Y -S. Keum, Q. X. Li

125. Nematicidal activity of marine algal natural products. **F. H. Abdel Rahman**, M. A. Saleh

126. Surface-modified zeolite Y for controlled paraquat release by ion-exchange process. **H. Zhang**, Y. Kim, P. K. Dutta

127. Protection of human health through safe disposal of pesticide containers in Chile. **V. Garrido**, R. Jobin, E. Urzúa, G. Ojeda, E. Flanagan, H. Marlow

128. Utilization of fungi for production of colorants. **F. Alihosseini**, G. Sun

Section E: Agrochemical Education Awards For Graduate Student Travel: Research Poster Presentations

J. J. Johnston, *Organizer, Presiding*

129. Using biomimetic PDMS fibers to determine the bioavailability of pyrethroids in sediment. **W. Hunter**, Y. Xu, J. Gan, F. Spurlock

130. The sorption of thiobencarb to soils: Mechanistic findings. **A. S. Gunasekara**, T. M. Young, R. S. Tjeerdema

131. Effects of pesticide programs for cotton on soil microbial activity. **S. H. Lancaster**, S. A. Senseman, R. L. Haney, F. M. Hons, J. M. Chandler

132. Indoor exposure to pyrethroid pesticides following fogger use or crack and crevice treatment by homeowners. **J. J. Keenan**, Y. Li, R. S. Gold, X. Zhang, G. Leng, R. I. Krieger

133. MicroRNAs: New players in plant responses to agrochemicals and environmental stress. **B. Zhang**, T. A. Anderson

134. Modification of polymer flocculants for the removal of atrazine from water. **T. S. Goebel**, K. J. McInnes, S. A. Senseman, E. E. Simenak

135. Evaluation of essential oil mixtures for mosquito repellency. **G. Schultz**, J. Coats

136. Effects of dietary conjugated linoleic acid on European corn borer pupae and adults. **L. J. Gereszek**, D. C. Beitz, J. Coats

137. Response of pre-spawn coho salmon to pesticides in urban streams in western Washington. **K. A. King**, C. E. Grue, J. W. Hearsey, J. M. Grassley

138. Olfactory performance in salmonids exposed to aquatic herbicides. **C. A. Curran**, J. M. Grassley, C. E. Grue

139. Examination of the fate of *Bacillus thuringiensis* Cry3Bb1 protein in a soil microcosm. **K. R. Prihoda**, J. R. Coats

140. Environmental studies on the fate of pharma proteins produced in transgenic corn. **H. Kosaki**, J. Wolt, J. R. Coats

141. Environmental fate of a veterinary antibiotic: Tylosin. **D. Hu**, J. R. Coats

142. Proposed field study to evaluate phytoremediation and best management practices for removal of atrazine from agricultural runoff. **V. L. Williams**, J. R. Coats

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The above graduate students received travel grants to present their research.
First, second, and third place winners will be announced at
The Division of Agrochemicals Social Hour on Tuesday evening.

Please encourage these and all our young scientists to consider applying for the
Young Scientist Pre- and Post-Doctoral Research Award for
The ACS Spring 2007 National Meeting in Chicago, Illinois.
Deadline for submittal of application materials is November 5, 2006.
See page 29 for details and application.

Section F: Recent Advances in Immunochemistry and their Applications to Agrochemicals Poster Session

J. M. Van Emon and W. L. Shelver, *Organizers, Presiding*

143. Phage-borne peptide haptens for polyclonal antibody-based heterologous immunoassay. **H.-J. Kim**, A. Gonzalez-Techera, G. G. Gonzalez-Sapienza, K. C. Ahn, S. J. Gee, B. D. Hammock

144. RIDA®QUICK Aflatoxin: A new approach for mycotoxin analysis. **J. Winkle**, W. Lubbe, S. Haas-Lauterbach

145. Stabilization of a ractopamine enzyme conjugate in aqueous solution, a rapid and convenient immunoassay method for the detection of ractopamine. **G. Wang**, W. Rodrigues, A. Agrawal, H. Philips, E. Abolencia, M. Nuguyen, D. J. Smith, W. L. Shelver

146. Compact discs as analytical platform for multi-residue immunosensing. **S. Morais**, R. Puchades, Á. Maquieira

147. Determination of clenbuterol by a portable surface plasmon resonance analyzer. **Y. Dong**, C. Wang, X. Qi, F. Guo, M. Zou

148. Novel gluten/allergen rapid testing format. **P. R. Goodwin**

149. A portable surface plasmon resonance analyzer for the determination of ß-agonist growth promoters. **Y. Dong**, Y. Tan, X. Qi, M. Zou

150. Enzyme-linked immunosorbent assay (ELISA) method for monitoring 2,4-dichlorophenoxyacetic acid (2,4-D) exposures. **J. M. Van Emon**, J. C. Chuang, J. Durnford, K. W. Thomas

151. Immunological assay for BDE-47 (2,2',4,4'-tetrabromodiphenyl ether) in biological samples. **K. C. Ahn**, S. J. Gee, B. D. Hammock

152. Controlling the spread of TSEs by diagnosis of meat and bone meals and animal feeds: Review of methods. **B. R. Ritter**

153. Development of a permethrin magnetic particle-based ELISA. **F. Rubio**, C. Parrotta, L. Kamp, J. Church, L. H. Stanker

154. Microfluidic immunochemical ractopamine analysis. X. Qi, W. L. Shelver, **Y. Dong**, M. Zou

155. Multiplexed immunoassays with quantum dots as fluorescent reporters for biomonitoring of exposure to agrochemicals. **M. Nichkova**, D. Dosev, A. Davies, S. Gee, B. D. Hammock, I. M. Kennedy

156. Development of a sensitive enzyme-linked immunosorbent assay for the detection of a human urinary biomarker, 3-PBA. **H.-J. Kim**, K. C. Ahn, S. J. Ma, S. J. Gee, B. D. Hammock

157. Performance validation of the flow through rapid test and microtitre plate enzyme immunoassay test for ochratoxin A in wine using a quantitative HPLC method. **L. Sibanda**, S. De Saeger, R. Verheijen, C. Arts, E. Grutters, L. Streppel, C. Van Peteghem

Section G: Synthetic Pyrethroids and Surface Water Quality Poster Session

J. Gan, F. Spurlock, and P. Hendley, *Organizers*

158. Effects of pyrethroid insecticides on early life stages of Chinook salmon *(Oncorhynchus tshawytscha)*. **I. Werner**, K. J. Eder, J. P. Phillips, M. Clifford, R. P. Hedrick

159. Solving the matrix interference problem for identification of pyrethroid insecticides by gas chromatography. **J. You**, M. J. Lydy

160. Multi-residue method for the determination of eight synthetic pyrethroids in sediment using gas-liquid chromatography with negative ion chemical ionization mass spectrometry detection. **N. Robinson**, N. Poletika, E. Olberding, C. Lam, G. Westberg

161. Solid-phase microextraction (SPME) measurement of pyrethroids in sediment porewater. **S. Bondarenko**, W. Hunter, J. Gan

162. Determining the occurrence toxicity, and composition of mixtures of urban-use insecticides. **A. J. Trimble**, M. J. Lydy

163. Pyrethroid insecticides in California surface waters: Concentrations and estimated toxicity. **K. Starner**

164. Effect of temperature on the toxicokinetics of pyrethroid insecticides in *Chironomus tentans*. **A. D. Harwood**, M. J. Lydy

165. Influences of aquatic plants on the fate of the pyrethroid insecticide λ-cyhalothrin in aquatic environments. **L. H. Hand**, J. S. Warinton, S. F. Kuet, S. J. Maund

166. Piperonyl butoxide as a tool to identify pyrethroid toxicity in field sediments. **E. L. Amweg**, D. P. Weston

167. Development of an aquatic toxicity database for synthetic pyrethroids. **J. M. Giddings**, J. S. Warinton, M. G. Dobbs

168. Esfenvalerate and chlorpyrifos differentially affect native Pacific Northwest aquatic insects. **K. Johnson**, J. Jenkins, P. Jepson

169. National pyrethroid aquatic exposure analysis (1): Relative erosion potential summarized by watershed. **J. M. Cheplick**, P. L. Havens, P. Hendley, S. H. Jackson, G. J. Sabbagh

170. National pyrethroid aquatic exposure analysis (2): Regional sensitivity to drift and erosion entry. **A. M. Ritter**, P. Hendley, M. G. Dobbs, G. J. Sabbagh

171. National pyrethroid aquatic exposure analysis (3): Combining potential vulnerability from spray drift, erosion and pyrethroid use. **C. Holmes**, P. L. Havens, P. Hendley, S. Jackson, G. J. Sabbag

172. Method for calculating the USLE LS-factor for erosion risk assessments in large watersheds. **M. F. Winchell**, S. H. Jackson, A. Wadley, R. Srinivasan, P. Hendley

173. Runoff potential of esfenvalerate from a prune orchard with managed floors. **S. L. Gill**, R. Sava, F. Spurlock

174. Reduction of pyrethroid runoff from a commercial nursery. **W. Lao**, F. F. Ernst, C. Martinez, D. L. Haver, J. N. Kabashima, J. Gan

WEDNESDAY MORNING

Sterling Hendricks Memorial Lectureship

Sponsored by AGFD
Cosponsored by AGRO and USDA-ARS
M. H. Tunick, *Organizer, Presiding*
See page 18 for abstracts and symposium program

Marriott -- Salon 8

8:00 — Introductory Remarks and Presentation of Award.

8:15 —AGFD 198. Synthetic prions, mad cows, and scientific heresy. **S. B. Prusiner**

9:00 — Reception.

Section A: Marriott -- Salon 1

Plant Nutrient Issues Impacting Trade, Water, Air, & Soils: Contaminant Issues

B. Hall, *Organizer*

9:00 — Introductory Remarks.

9:05 —175. Bioavailable metal concentrations from a heavy metal-rich fertilizer dose field study as measured by Diffusive Gradient Thin Films. **A. L. Pérez**, K. A. Anderson

9:25 —176. Phytoremediation of metals and salts while growing a better ethanol source crop. **R. C. Bost**, M. L. McGregor

9:45 —177. Development of improved methods of analysis for trace metals in fertilizer materials and blends. **W. L. Hall Jr.**, P. F. Kane

10:05 — Intermission.

10:30 —178. Perchlorate deposition in precipitation in the continental United States and selected northern hemisphere locations. **A. Jackson**, S. Rajagopolan, T. Anderson, K. Harlin, N. Kang

10:50 —179. Natural occurrence of perchlorate in groundwater: Implications for dietary exposure. **D. R. Parker**, A. L. Seyfferth, B. K. Reese, S. R. Jackson

11:10 —180. Analytical methods for the determination of perchlorate anion in foods. **R. A. Niemann**, A. J. Krynitsky

11:30 —181. California best management practices (BMP) for perchlorate materials. **M. Khosravifard**

Section B: Marriott -- Salon 2

Agricultural Impacts on Air Quality

L. L. McConnell, J. N. Seiber, C. J. Hapeman, and M. S. Majewski, *Organizers*
O. Hertel, *Organizer, Presiding*

9:00 —182. Volatile organic compound emissions from pesticides. **R. T. Segawa**

9:25 —183. Near-field air quality impacts from fumigant applications. **R. Reiss**

9:50 —184. Micrometeorological effects on metolachlor volatilization: An 8-year case study. **J. H. Prueger**, T. J. Gish, L. L. McConnell, L. G. Mckee

10:15 — Intermission.

10:30 —185. Characterization of ammonia and hydrogen sulfide emissions from a swine farm in North Carolina. J. Blunden, **V. Aneja**, P. W. Westerman

10:55 —186. Agricultural ammonia emissions, uncertainty, and applications to air quality modeling. **R. W. Pinder**, P. J. Adams, A. B. Gilliland

11:20 —187. Effects of microbial additives on odor quality of swine slurry. **H. Kim**, J. Kim, H. L. Park, S. Y. Park, Y. J. Heor, H. L. Choi

Section C: Marriott -- Salon 3

Weed Resistance to Herbicides Modes of Action and Mechanisms of Resistance

Cosponsored with Monsanto Corporation
W. P. Ridley, R. D. Sammons, and A. S. Felsot, *Organizers, Presiding*

9:00 —188. Role of herbicide metabolism in weed resistance to herbicides. **D. E. Riechers**, Q. Zhang

9:30 —189. Characterization of an exclusion mechanism for glyphosate resistant weeds. **R. D. Sammons**, R. Eilers, M. Tran, D. R. Duncan

10:00 — Intermission.

10:20 —190. New insights into auxin herbicide resistance. **T. A. Walsh**

10:50 —191. Ecology and evolution of herbicide resistant weeds. **J. Holt**

11:20 —192. Challenges to modeling the selection and spread of glyphosate-resistant weeds. **D. I. Gustafson**

WEDNESDAY AFTERNOON

Section A: Marriott -- Salon 1

Plant Nutrient Issues Impacting Trade, Water, Air, & Soils: Nutrient Issues

B. Hall, *Organizer*

1:30 —193. Atmospheric deposition of nitrogen in precipitation across the United States. **K. Harlin**

1:50 —194. Nutrient movement below cattle feedlot operations in Kansas. **G. C. Vaillant**, G. M. Pierzynski, J. M. Ham, T. M. DeSutter

2:10 —195. Assessing the water quality significance of nitrogen and phosphorus compounds concentrations in agricultural runoff. **G. F. Lee**, A. Jones-Lee

2:30 —196. Is agriculture ready for enhanced efficiency fertilizer products? **A. D. Blaylock**

2:50 — Intermission.

3:10 —197. Development of methods for measuring timed release nutrients in the lab and in soil. **W. L. Hall Jr.**, J. B. Sartain, A. D. Blaylock

3:30 —198. Advances in the simultaneous determination of nitrogen and other key elemental constituents of fertilizers using inductively coupled plasma emission spectroscopy. **D. L. Pfeil**, M. Almeida, C. Seeley

3:50 —199. Measuring and improving physical properties of fertilizer materials and blends. **M. Ogzewalla**

4:10 —200. Harmonizing methods of analysis for international shipments of fertilizer materials. **W. L. Hall Jr.**

4:30 — Concluding Remarks.

Section B: Marriott -- Salon 2

Agricultural Impacts on Air Quality

C. J. Hapeman, O. Hertel, M. S. Majewski, and J. N. Seiber, *Organizers*
L. L. McConnell, *Organizer, Presiding*

1:30 —201. Finding stinky "needles" in the chemical "haystack" of livestock odor: Efforts towards solving livestock odor problems with SPME and multidimensional GC-MS-O. **J. A. Koziel**, L. Cai, D. Wright, S. Hoff

1:55 —202. Inverse modeling: A tool for evaluation of ammonia emission inventories. **A. B. Gilliland**, R. W. Pinder

2:20 —203. Simulating the atmospheric concentration and deposition of ammonia on a small scale. **J. van Jaarsveld**, W. van Pul, M. Smits

2:45 — Intermission.

3:05 —204. Modeling dry deposition of atmospheric pesticides to an agricultural watershed in Washington. **P. D. Capel**, A. W. Ohrt

3:30 —205. Pesticides in Canadian prairie air: The ups and downs. **D. Waite**, J. Sproull, J. Slobodian

3:55 —206. Past and currently used pesticides in the air and precipitation in Québec, Canada. **L. Poissant**

4:20 —207. Technologies to reduce pollution of the air with pesticides. **E. Ozkan**

Section C: Marriott -- Salon 3

Recent Advances in Immunochemistry and their Applications to Agrochemicals: Arrays, Immunosensors, and Nanotechnology

W. L. Shelver, *Organizer*
J. M. Van Emon, *Organizer, Presiding*

1:00 — Introductory Remarks.

1:05 —208. Use of liquid suspension array technology to measure environmental, bioterrorism and immunodiagnostic analytes. **R. E. Biagini,** D. L. Sammons, J. P. Smith, C. A. F. Striley, B. A. MacKenzie, J. E. Snawder, S. A. Robertson

1:25 —209. New microarray developments: On-chip microfluidics and electrasense detection technology. **K. Dill**, R. H. Liu, A. L. Ghindilis, K. R. Schwarzkopf, S. Fuji, T. T. Nguyen, A. McShea

1:45 —210. Multiplex immunochemical detection of food contaminants and adulterants. **W. Haasnoot**, J. Du Pre, J. Bastiaans, M. Bienenmann, H. van Eekelen

2:05 —211. Microbead immunoassays for detecting biological agents in finished water. **W. R. Heineman**, H. B. Halsall, C. J. Seliskar, J. H. Thomas, S. Farrell, J. Tu, C. Wansapura, A. Jurkevica, H. Kuramitz

2:25 —212. Kinetic exclusion immunosensors for low molecular weight environmental contaminants. **D. A. Blake**, S. J. Melton, H. Yu, X. Li, R. C. Blake II

2:45 — Intermission.

3:00 —213. Nanosensor for environmental monitoring and public safety. **Y. Zhou**

3:20 —214. Functionalized porous silicon: Tunable platforms for bioanalytical sensor design. **L. A. Porter Jr.**

3:40 —215. Nanotechnology for immunochemistry and detection of infectious agents. **A. Agrawal**, T. Sathe, S. Nie

4:00 —216. Organophosphorus hydrolase multilayer modified microcantilevers for organophosphorus detection. **C. Karnati,** H. Du, H -F. Ji, Y. Lvov, A. Mulchandani, P. Mulchandani, W. Chen

THURSDAY MORNING

Section A: Marriott -- Salon 1

Recent Advances in Immunochemistry and their Applications to Agrochemicals: Immunoassays and Immunoaffinity Chromatography

J. M. Van Emon, *Organizer*
W. L. Shelver, *Organizer, Presiding*

8:00 — Introductory Remarks.

8:20 —217. Immunochemical analysis of agrochemicals: Trends and perspectives. **B. G. Hock**, K. Kramer

8:40 —218. Recent advances in sol-gel immunochemistry: Application for agrochemical monitoring. **M. Altstein**, A. Bronshtein

9:00 —219. Analysis of environmental contaminants by rapid chromatographic immunoassays and on-line immunoextraction. **D. S. Hage**

9:20 —220. Immunoaffinity chromatography coupled with LC-MS for the identification and determination of pyrethroids and 3-phenoxybenzoic acid in environmental samples. **G. Xiong**, J. M. Van Emon

9:40 —221. Application of immunoassay using monoclonal antibody in the field of agrochemicals. **Y. Shoyama**, H. Tanaka

10:00 — Intermission.

10:15 —222. Affinity purification of antibodies to hydrophobic and hydrophilic pesticides: Generic elution techniques and assessment methods for preparative scale chromatography. **R. A. Abuknesha**

10:35 —223. Quality assurance and validation with immunoassays. **R. J. Schneider**

10:55 —224. Assessment of an improved enzyme-linked immunosorbent assay (ELISA) and a novel LC-MS method for urinary atrazine mercapturate analysis. **M. E. Koivunen**, K. Dettmer, R. Vermeulen, B. Bakke, S. J. Gee, B. D. Hammock

11:15 —225. Evaluation of an enzyme-linked immunosorbent assay (ELISA) for monitoring 3-phenoxybenzoic acid in urine. **J. M. Van Emon**, J. C. Chuang, J. Finegold, R. M. Trejo, J. Durnford

11:35 —226. Development of a fluorescence polarization immunoassay for the organophosphorus pesticide pirimiphos-methyl. D. H. Chung, J. M. Choe, W. B. Shim, Y. Z. You, Y. T. Lee, A. Y. Kolosova, **S. A. Eremin**

Section B: Marriott -- Salon 2

Agricultural Impacts on Air Quality

L. L. McConnell, C. J. Hapeman, M. S. Majewski, and O. Hertel, *Organizers*
J. N. Seiber, *Organizer, Presiding*

8:30 —227. Legacy pesticides in North American air: Long-range transport or "ghosts of the past"? **T. F. Bidleman**, P. B. Kurt-Karakus, R. M. Staebler, K. C. Jones, M. T. Scholtz, F. Wong, H. A. Alegria

8:55 —228. Wet and dry atmospheric deposition of pesticides in the San Joaquin Valley, California. **M. S. Majewski**, C. Zamora, W. T. Foreman, C. Kratzer

9:20 —229. Pesticide concentrations in rainfall and resulting runoff. **W. T. Foreman**, M. S. Majewski, C. Zamora, C. Kratzer

9:45 — Intermission.

10:00 —230. Pesticides in the atmosphere of the Delmarva Peninsula. **A. Goel**, L. L. McConnell, A. Torrents

10:25 —231. Atmospheric transport and deposition of pesticides in south Florida. **C. J. Hapeman**, J. A. Harman-Fetcho, T. L. Potter, L. L. McConnell, C. P. Rice, R. Curry, B. A. Schaffer

10:50 —232. Spray irrigation of treated municipal wastewater as a potential source of atmospheric PBDEs. A. Goel, **L. L. McConnell**, A. Torrents, J. Scudlark, S. L. Simonich

11:15 — Discussion. Symposium wrap-up. **J. Seiber.**

THURSDAY AFTERNOON

Section A: Marriott -- Salon 1

Recent Advances in Immunochemistry and their Applications to Agrochemicals: Antibody and Biological Reagent Development

W. L. Shelver, *Organizer*
J. M. Van Emon, *Organizer, Presiding*

1:00 —233. Evolutionary approaches for addressing antibody selectivity, affinity, and stability. **K. Kramer**

1:20 —234. Development of monoclonal antibodies specific for ricin. **D. L. Brandon**, L. W. Cheng, X. He, J. M. Carter

1:40 —235. Development of new monoclonal antibodies specific for *Botulinum* neurotoxin type A. **L. H. Stanker**, P. A. Merrill, L. W. Cheng, J. M. Carter, D. L. Brandon

2:00 —236. Aptamer ligands for agrochemical applications. **M. Mascini**

2:20 —237. Development of targeted affinity reagents by selection, amplification, and selfassemblage of phage fusion proteins. **V. A. Petrenko**

2:40 — Wrap-up and celebration of immunochemistry.

Section B: Marriott -- Salon 2

Characterizing Natural Products as Pesticides, Repellents, or Biomarkers

R. S. Stahl, *Organizer, Presiding*

1:00 —238. Glucosinolates and cyanohydrins as potential methyl bromide replacements. **J. Coats**, D.-S. Park, C. J. Peterson, S. Zhao

1:20 —239. Caffeine formulation for avian repellency. S. J. Werner, J. L. Cummings, S. K. Tupper, **J. C. Hurley**, R. S. Stahl, T. M. Primus

1:40 —240. Monoterpene activity against insects. **G. E. Schultz**, J. Coats

2:00 —241. Inhibition of fungal biofilm formation using quorum sensing chemicals. M. A. Saleh, F. H. Abdel Rahman, **B. Woodard**, S. Clark, C. Wallace, W. L. Zhang, J. Walker

2:20 — Intermission.

2:30 —242. Natural product based amides against Formosan subterranean termites (*Coptotermes formosanus*). **K. M. Meepagala**, W. Osbrink, A. Ballew, A. R. Lax, S. O. Duke

2:50 —243. Synthesis and evaluation of petuniasteroid analogs. **J.-L. Giner**, J. A. Faraldos, M. Isman, Y. Akhtar

3:10 —244. Synthesis and evaluation potential of nestmate recognition cues in the Argentine ant (*Linepithema humile*). **R. Sulc,** K. J. Shea, N. D. Tsutsui, M. Brandt, C. W. Torres, M. Lagrimas

3:30 —245. Evaluating the use of trans fatty acids for determining anthropogenic food sources in the diet of bears. **R. S. Stahl**, S. W. Breck, P. Callahan, J. J. Johnston

DIVISION OF AGROCHEMICALS

1. HPLC/MS determination of azinphos-methyl metabolite degradation in apples

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Methods for the determination of azinphos-methyl, an organophosphorus pesticide commonly used with tree fruit, as well as the oxygen analog and dialkylphosphate metabolites of this compound have been developed using high performance liquid chromatography with mass selective detection. OP pesticides and their metabolites are usually determined by gas chromatographic analysis. However, the thermal instability of these compounds renders GC problematic. This problem is not encountered with LC and the mass selective detection permits greater confidence in the identification and quantitation of these compounds. By considering the latter oxygen analog and metabolites of azinphos-methyl, a more realistic understanding of exposure may be obtained than is the case for more typical approaches. Usually, fruit is analyzed only for the parent compound, and exposed individuals are tested only for the presence of metabolites in the urine. This approach neglects potential sources of dialkylphosphate compounds other than pesticide metabolism.

2. DNA adducts as biomarkers for pesticide oxidative stress and genotoxicity

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DNA from plants in our laboratories demonstrates that plant DNA is susceptible to attack by pesticides. Nucleotide analysis carried out by ^{32}P post-labeling reveals the presence of adducts of pesticide molecules or their metabolites. The presence of 1,N^2-(1,3-propano)-2'-deoxyguanosine derivatives from 4-hydroxynonenal and hexenal are evidence of oxidative stress from pesticide use via lipid peroxidation. As a consequence, adduct formation serves as a biomarker for genotoxic or oxidative stress sustained by crop plants. These stress factors lead potentially to poor development of roots, foliage, or fruit and lower crop yields. In this study, we explore the effects of oxidative and genotoxic stress from several members of three classes of herbicides, the benzoic acids, the phenoxyacetic acids, and the triazines. Results of *in vivo* and *in vitro* studies are considered. Experimental results are examined in conjunction with molecular modeling of reactivity and binding potentials to establish structure-activity relationships.

3. Chloropyridinyl neonicotinoid insecticides: Diverse molecular substituents contribute to facile metabolism in mice

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Imidacloprid (IMI), nitenpyram (NIT), thiacloprid (THI), and acetamiprid (ACE) have in common the 6-chloro-3-pyridinylmethyl group but differ in the nitroguanidine, nitromethylene or cyanoamidine substituent on an acyclic or cyclic moiety. They were administered ip to mice at 10-20 mg/kg for analysis of brain, liver, plasma, and urine by HPLC/DAD, LC/MSD, and LC/MS/MS. Each compound was partially cleaved leading to the same eight urinary chloropyridinylmethyl-derived metabolites and various fragments from the rest of the molecule. IMI gave nitrosoguanidine, aminoguanidine, guanidine, olefin, methyltriazinone, and hydroxy- and dihydroxyimidazole derivatives. NIT metabolism involved *N*-demethylation and conversion of the nitromethylene substituent to carboxylic acid and cyano derivatives. THI yielded olefin, descyano, descyano olefin, urea, and hydroxythiazolidine metabolites and a ring-opened and methylated THI sulfoxide. ACE formed *N*-desmethyl and acetamide derivatives plus chloropyridinylmethylamine and *N*-methylchloropyridinylmethylamine. Despite their common metabolites, these neonicotinoids differ greatly in their sites of metabolism and persistence in mice.

4. Risk assessment of groundwater contamination by imidacloprid leaching in different types of soils

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The leaching of imidacloprid, 1-((6-chloro-3-pyridinyl)-methyl)-4,5-dihydro-*N*-nitro-1*H*-imidazole-2-amine, was studied in three types of soil viz. sandy, sandy loam, and clayey soil varying in soil pH, organic carbon, and clay content. Imidacloprid is a polar molecule (Log P_{ow} = 0.57) with high water solubility 510 mg/L. Imidacloprid is a hydrolytically stable insecticide but more rapidly photodegraded in water (hours) than in soil (months). A leaching experiment was carried out in a packed column (35 x 6 cm) with soil up to 25 cm. Treated soil (10 gm soil + 1000 mg imidacloprid) was spread at top. A constant head of 2 cm water was maintained. Five fractions of 500 mL leachate were collected. The total 2.5 L simulates 88 cm of rainfall. The soil core was pushed down and sliced into 5 cores of 5 cm each. A major portion was found in top 0-5 cm soil layer. Imidacloprid recovered in 0-5 cm layer was 96, 97, and 99% in sandy, sandy loam, and clayey soil, respectively. Imidacloprid leached down 10-15 cm core in sandy soil while in others it remained till 10 cm core. Only 0.2-4.0% imidacloprid was recovered in leachate of 3 different soil types. Leaching was highest in sandy soil followed by sandy loam and clayey soil. The trend in leaching could be explained based on organic matter and clay content.

5. Analysis of manure-derived oxytetracycline in amended soil

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As a member of tetracycline antibiotic family, oxytetracycline is widely administered to animals. With the application of manure from medicated animals as fertilizer into agricultural land, oxytetracycline may enter the environment. For studying oxytetracycline contamination and its fate in agricultural soil, an analytical method was developed to analyze oxytetracycline in manure amended soils. Sixteen grams of manure-amended soil was extracted with 2.5 g citric acid, 1.5 oxalic acid, and 15 mL methanol:water = 90:10 solution and extraction was repeated for a total of 3 times. Extract was directly analyzed with high performance liquid chromatography. The extraction recovery of the developed method showed to be much higher than those with 2% HCl methanol or pH = 4 EDTA-McIlvaine buffer. Effect of manure amended ratio, manure type, and soil type on extraction recovery was investigated. Detection limit, linearity, and specificity of the developed method were also studied.

6. Excretion of ^{14}C-α-chloralose from mallard ducks following a single, oral dose

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α-Chloralose is an anesthetizing chemical used to aid in the capture of nuisance birds. It causes central nervous system depression, which makes the affected birds easier to capture and minimizes injury to the birds during capture. To prevent possible human ingestion of α-chloralose, there is a 30 day moratorium on α-chloralose use with respect to hunting season. This moratorium limits the usefulness of this wildlife management technique. To generate pharmacokinetic data which could possibly lead to reducing the length of this moratorium, we conducted an experiment to identify the absorption and excretion of α-chloralose. Mallard ducks were given a single dose of ^{14}C labeled α-chloralose. Expired air and excreted feces were collected and analyzed for ^{14}C content. Once excretion levels returned to near-background levels, the birds were euthanized and their organs were removed and analyzed for ^{14}C content. Results indicated that α-chloralose is rapidly excreted from the birds with approximately 80% of the radioactivity excreted in the first 24 hours and total excretion levels returning to near-background within 3 days of dosing.

7. Transformation of two chlorinated fumigants by hydrogen sulfide species

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The chlorinated fumigants chloropicrin and 1,3-dichloropropene (1,3-D) are extensively used to control soilborne pests. Transformation of these two pesticides by hydrogen sulfide species (H_2S and HS^-) was examined in well-defined anoxic aqueous solutions. Chloropicrin underwent an extremely rapid redox reaction in the hydrogen sulfide solution. Transformation products indicated reductive dechlorination of chloropicrin by hydrogen sulfide species to produce dichloro- and chloronitromethane. For 1,3-D, kinetics and transformation products analysis revealed that the reaction between 1,3-D and hydrogen sulfide species is an S_N2 nucleophilic substitution process, in which the chlorine at C3 of 1,3-D is substituted by the sulfur nucleophile to form corresponding mercaptans. The transformation of chloropicrin and 1,3-D in hydrogen sulfide solution significantly increased with increasing pH, suggesting that the reactivity of hydrogen sulfide species stems primarily from HS^-. Because of the relatively low smell threshold values and potential persistence of organic sulfur products, the environmental behaviors of transformation products of 1,3-D and HS^- need be assessed.

8. Development of an analytical method to quantify and identify multiple pesticides, antibiotics, and other residues in honey

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Honey is an important commodity in countries around the world, particularly in Turkey, which must meet the regulations of export markets. For analytical testing of honey, the use of a single method for diverse chemical residues (e.g., pesticides and antibiotics) would save time, cost, and labor versus the current approach of using several different methods. A list of >40 analytes was compiled based on Turkey and U.S. regulations and monitoring needs, which include naphthalene, chloramphenicol, tetracyclines, sulfonamides, streptomycin, and many pesticides. The QuEChERS approach was evaluated for sample preparation, and gas chromatography/mass spectrometry (GC-MS) and liquid chromatography/tandem mass spectrometry (LC-MS/MS) were used for identification and quantification of the diverse analytes. For GC-MS, a unique automated, large-volume direct sample injection approach was used to lower detection limits and improve ruggedness. Novel aspects related to the development of a single method to cover such a wide range of chemical residues will be presented.

9. Overview of agricultural fumigation: Past, present, and future

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Methyl bromide (MeBr) has been widely used since the 1940's to prepare soil for crop production. Its success as a soil fumigant is largely due to a wide spectrum of control against pests during many stages of life, the ability to rapidly penetrate soils, and the ease of application. However, in 1991, MeBr was identified as a stratospheric ozone-depleting compound, which has led to its phase-out in the United States. Economic assessments have indicated that a MeBr phase-out could have a substantial adverse impact on many agricultural commodities because alternative control practices are either less effective or more expensive than MeBr fumigation. Further, in 1997, USEPA promulgated a national ambient 8-hour near-surface ozone air-quality standard that affects the use of volatile organic chemicals (VOCs), such as soil fumigants, in air basins not meeting the standards. Nationwide, approximately 300 counties could be classified as not complying with this new air-quality standard and may require limits on the use of VOCs. The purpose of this presentation is to provide an overview of the problems facing soil fumigation, current approaches to reduce harmful environmental effects from fumigant use, and to offer possible areas of future research that may assist in protecting the environment and lead to the continued use of this important class of chemicals.

10. Economic feasibility of methyl bromide alternatives

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Technical feasibility is a necessary but not sufficient condition to establish economic feasibility. Technical feasibility emphasizes control of one or more of the following: weeds, fungi, nematodes, and insects. Pesticide registrations are based on technical information but involve substantial economic investment for uncertain outcomes. The economic viability of an alternative also depends on it fitting into the existing production system. Partial budget analysis examines the impacts of alternatives on costs and revenues and is a standard economic framework used to compare alternatives. The net impact of these changes is the theoretically correct measure to compare alternatives. Alternatives may differ in effectiveness in terms of crop yield but still be competitive because economics factors can offset differences in performance. Analyses of U.S. nominations for critical use exemptions for continued use of methyl bromide under Decision IX/6 of the Montreal Protocol illustrate the economic competitiveness of currently available alternatives.

11. Ten years of field development of alternative soil fumigants: Lessons learned

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Beginning with Basamid (BASF), a solid formulated MITC generator on strawberries, tomatoes and turf, Pacific Ag has conducted over 300 field experiments for registration of a variety of soil and commodity applied methyl bromide alternative products. This presentation will review some field directed experiments that have been conducted on existing fumigants, such as Telone and chloropicrin, as well as some newer methyl bromide replacement fumigants, such as iodomethane (Midas) and dimethyldisulfide (Cerexagri). Pacific Ag has conducted a variety of study types including development activities associated with shank and drip applied fumigation techniques, efficacy, environmental fate, commodity residues, and flux and worker exposure. In addition to these more commonly known alternatives, various other compounds are under development by companies and governmental agencies. These will be discussed briefly in light of their individual biological advantages, developmental potential, and/or limitations with respect to commercial potential in the primary fumigant markets. In addition to specific data by fumigant compound, generalities across this chemical class, such as unique application requirements of fumigants, regulatory requirements of the field researcher, fumigant safety considerations, and other lessons learned from over ten years of field research with chemical fumigants, will be discussed.

12. Fumigant use trends in California: Response to the MeBr phaseout

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The Pesticide Use Reporting (PUR) requirements in California allow tracking of the uses of methyl bromide (MeBr) and alternative fumigants during the phaseout. Use of MeBr declined gradually between 1991 and 1999, the first year of the phaseout. In 2000 and 2001, use dropped dramatically - the result of a price increase and restrictive California regulations - and remained below phaseout levels. MeBr use in 2003 and 2004 exceeded the phaseout limit through use of material carryover from prior years and Quarantine Exemptions. The MeBr reduction has been achieved primarily through full or partial substitution of alternative fumigants and by reduced fumigated acreage of some crops. Since 1,3-D was re-introduced in California in 1995, use of this product has increased substantially. Chloropicrin use increased due to increasing proportions of chloropicrin in MeBr/chloropicrin mixtures. Metam sodium is the most widely used fumigant in California, but is not often used as a replacement for MeBr.

13. Complexities of the registration process for the six main agricultural fumigants with particular reference to metam sodium and MITC

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The registration/re-registration of the six main agricultural fumigants (methyl bromide, 1,3-dichloropropene, iodomethane, metam sodium, dazomet and chloropicrin) present several new and unusual problems for the US regulatory authorities. The fumigants are all at different stages of the regulatory cycle but their use patterns are interrelated. One of the main areas of concern is bystander exposure for which there are at least three potential modeling systems, all of which have been approved for use by the SAP. To add to the complexity, at least two of the compounds have human studies associated with the regulatory endpoint. These studies have still to be reviewed by the Human Studies Review Board (HSRB). The presentation will cover the latest position on this complex process with particular reference to metam sodium and MITC.

14. Dimethyldisulfide: A new soil fumigant

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Soil fumigants are an important class of crop protection products that are typically used in pre-plant soil treatment. Soil fumigants are effective against soil born diseases, fungi, nematodes, weeds, etc. Over the past decades, several soil fumigants have been used worldwide, including the most popular, methyl bromide. An old class of chemicals had been demonstrated to have excellent efficacy in soil fumigation, especially when prepared as a new formulation of dimethyldisulfide (DMDS). Dimethyldisulfide is a naturally occurring product. It is found in various plants in the genus, *Allium*, which includes onions and garlic. Residues of DMDS are present in prokaryotes (bacteria, fungi, and algae), aquatic plants, some terrestrial plants (oak and pine), and in animal residues (human respired air, manure, milk, and oysters). DMDS is formed as a result of natural processes, such as the methionine degradation pathway, the dimethylsulfoniopropianate (DMSP) degradation pathway, and the biogenic atmospheric sulfur cycle. This paper discusses some of the chemical properties of dimethyldisulfide and some of the current investigations into its uses as a new soil fumigant.

15. Sodium azide-based pesticides

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Sodium azide (NaN_3) as an active ingredient in various pesticide formulations is an effective broad spectrum pesticidal agent. It has been used as a nematacide, herbicide, fungicide, and bacteriacide. When formulated and applied properly it is safe, clean and cost effective as well as being environmentally friendly. Other uses for sodium azide have been as a pharmaceutical, pharmaceutical intermediate, preservative and as an ingredient in airbag gas generants. Since the early 1900's sodium azide has successfully been tried in assorted experimental pesticides. In the 1970's, four azide (N_3) pesticides were registered and marketed by PPG. More recently American Pacific and Auburn University have to date developed three new formulations. SEPTM 100, a liquid formulation is applied utilizing drip systems, has proven to control a wide array of soil-borne pathogens in food and non-food crops as a methyl bromide alternative. SEPTM 100 is in the USEPA registration process with plans for foreign registrations.

16. Blockers of anion transporters as nematicidal alternatives to methyl bromide

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Loss of methyl bromide makes alternatives for nematode control an urgent need. The stilbene 3,5-dihydroxy-4-isopropylstilbene (DST), isolated from *Photorhabdus luminescens* bacteria that live inside nematodes of the genus *Heterorhabditis*, has paralytic/lethal activity against a variety of nematode species, including *Caenorhabditis elegans* and *Meloidogyne incognita* (K. Hu, J. Li, J. Webster. Nematology 1:457-469, 1999). Interestingly, the symbiotic nematodes within which the bacterium lives were completely insensitive to DST at concentrations up to 200 µg/ml. Since DST is structurally similar to 4,4'-diisothiocyanato-2,2'-stilbenedisulfonic acid (DIDS), a well-established blocker of anion transporters, the two compounds may share a similar mode of action on cell membranes which could be the basis of insecticidal or nematicidal activity. Accordingly, we have screened DIDS and related materials for nematicidal activity in the laboratory. *In vitro* toxicity assays showed that DIDS, NPPB, IAA-94, and 9-AC were paralytic/lethal to *M. incognita* in the low ppm range, but not to *H. bacteriophora* at 200 ppm. Thus, bona fide blockers of anion transporters showed a cross resistance pattern similar to that previously observed for DST. Studies using longer term exposures of *M. incognita* found that the endpoint LC_{50} for DIDS occurred at 72 hr indicating a slowly developing toxic action. Similar results were observed on nematode egg hatch *in vitro*. Activity in whole plant screens remains to be determined.

17. Implementation of transitional strategies to replace methyl bromide in Florida

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Florida growers are reluctant to adopt new integrated pest management strategies which include co-use of different fumigants, herbicides, and alternative cultural practices to achieve pest control efficacy and crop yield response similar to that of methyl bromide. Transition to alternatives also requires growers to implement other significant changes to current practices, including integration of new fumigant application technologies and tillage and irrigation practices to enhance performance and to reduce potential fumigant emissions from treated fields. Grower transition to these new IPM methods will be driven incrementally by methyl bromide supply and by many other on-farm, within field, pest, soil, crop, and economic considerations. Transitional strategies which schedule adoption over time and minimize changes to crop production and performance inconsistency of alternatives must be quickly documented for distribution to growers.

18. Determination of brodifacoum in Palmyra Atoll land crab tissue

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Rats have contributed to the extinction of indigenous flora and fauna on Pacific islands. Control methods considered for rats include broadcast application of anticoagulant rodenticides such as brodifacoum. When considering the use of rodenticides to control rats on islands, secondary hazards to non-target species must be evaluated. For example, land crabs have been observed consuming rodenticide baits following brodifacoum baiting operations and some avian species consume crabs as part of their diet. Therefore, a study was conducted to determine if crabs accumulate brodifacoum at levels which pose a significant risk to avian species that consume crabs. Reversed-phase ion-pair liquid chromatography using fluorescence detection combined with a solid phase extraction clean-up was used to quantify brodifacoum residues in crabs. Difenacoum was used as a surrogate. Tissues were extracted with acetone:chloroform. The extract was dried, reconstituted with hexane:chloroform, and cleaned up by normal phase aminopropyl solid phase extraction.

19. Sample preparation for determination of contaminates in foods and grains using Accelerated Solvent Extraction (ASE®)

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The presence of chemicals and environmental contaminates in food and grains has received increased attention by scientists, regulatory agencies, and the general public. Isolating these chemicals and contaminates, can be difficult and challenging for complex food matrixes. Currently, several approaches for sample extractions are being explored as part of the overall analytical scheme. The techniques that are currently used are sonication, blending, vortexing, and shaking. Accelerated Solvent Extraction (ASE) is an extraction technique that uses organic or aqueous based solvent for fast and efficient extractions. The use of elevated temperatures and pressures allow extractions to be done very quickly and with very little solvent. This presentation will discuss how ASE provides an effective solution to fulfill the difficult extraction needs of analytical laboratories. Agrichemicals studied for this presentation will include organochlorine pesticides, organophosphorus pesticides, herbicides, polychlorinated dioxins, and mycotoxins. The performance of ASE will also be compared to sonication, Soxhlet, and other standard techniques.

20. Reverse phase high performance chromatography method for the detection of rifampin in bovine plasma

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The antibiotic rifampin, 3-[[(4-methyl-1-piperazinal)imino]methyl]rifamycin, is being evaluated for the treatment of Brucellosis in wild American bison (*Bison bison*). Methods for delivery are being evaluated in a domesticated cow model system (*Bos taurus*). To support this effort, a reverse phase high performance liquid chromatography method was developed to quantify the parent compound Rifampin and two hydrolysis products, rifampin quinone, and 3-formyl rifampin, following solid phase extraction from a plasma sample. Details of the method developed for the extraction of the analytes from plasma and the chromatographic procedure for analysis are presented. The method has proven to be robust with good inter- and intra-day repeatability, recovery, and sensitivity during preliminary investigations.

21. Tissue distribution, elimination, and metabolism of sodium ^{36}Cl-perchlorate in lactating goats

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Perchlorate has contaminated water sources throughout the US, but particularly in the arid Southwest, an area containing large numbers of people and few water sources. Recent studies have demonstrated that perchlorate is present in alfalfa and that perchlorate is secreted into the milk of cows. Only a small portion of a perchlorate dose could be accounted for by elimination in milk, feces, or urine of orally administered cows. The purpose of this study was to determine the fate and disposition of ^{36}Cl-perchlorate in lactating dairy goats. Two goats (60 kg) were each orally administered 3.5 mg (16.5 µCi) of ^{36}Cl-perchlorate. Blood, milk, urine, and feces were collected incrementally until slaughter at 72 h. Total radioactive residues (TRR) and perchlorate were measured using radiochemical techniques and LC-MS/MS. Peak blood levels of TRR occurred at 12 h (~195 ppb); peak levels of parent perchlorate, however, occurred after only 2 h suggesting that perchlorate conversion to chloride occurred rapidly in the rumen. By 24 h, perchlorate was not detectable in blood, but TRR remained elevated (160 ppb) through 72 h. Milk perchlorate levels peaked at 12 h (157 ppb) and were not detectable by 36 h, even though TRR remained (69 ppb) through 72 h. Perchlorate was not detectable in skeletal muscle or liver at slaughter (72 h). Chlorite and chlorate were not detected in any matrix. Bioavailability of perchlorate was poor in lactating goats; perchlorate that was absorbed was rapidly eliminated in milk and urine.

22. Metabolism and residue depletion of ^{3}H-ivermectin in the muscle tissue of rainbow trout after oral administration

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Ivermectin, a broad spectrum antiparasitic drug, is approved for use in terrestrial food animals (cattle, swine and sheep), but not in aquatic species. The marker residue (MR) to monitor for potential violative residues in both liver and muscle tissues of the above animals is the parent drug. In this study, we investigated the residue depletion of ivermectin and its potential metabolites in the muscle tissue of a fish species, rainbow trout. ^{3}H-ivermectin at the dose level of 0.1 mg/kg (9.25 µCi) was administered to 42 rainbow trout in gel-capsules using a stomach tube and manual restraint. Six fish were used at each time periods and necropsy was performed at 1, 3, 7, 14, 28, 35, and 42 days post dose. Prior to necropsy, the fish were sedated with MS-222, euthanatized, de-scaled and the muscle fillets were collected. The muscles were homogenized and powdered in dry ice for the determination of total radioactive residue (TRR) and for liquid chromatographic (LC) analysis. Tissue Oxidizer was used to determine TRR, and LC was used to determine parent drug and its potential metabolites. The results showed that TRR peaked at post dose day 3 to about 60 ppb by Tissue Oxidizer and to about 54 ppb by LC. Further LC analysis indicated that by post dose day 35, about 70% of the parent drug ivermectin was converted into an unknown metabolite. The results of this study suggest that this metabolite may serve as a potential marker residue (MR) for ivermectin in rainbow trout, which is in contrast to cattle, swine, and sheep where the MR is parent ivermectin.

23. Aromatics catabolism and protein regulation in *Mycobacterium sp.* JS14

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Fluoranthene is a representative polycyclic aromatic hydrocarbon (PAH) often found in PAH-contaminated soil. Catabolism of fluoranthene and associated proteins in *Mycobacterium sp.* JS14, a bacterial isolate from a highly PAH-contaminated soil in Hilo, Hawaii, were elucidated. An increased expression of 23 proteins in relation to fluoranthene metabolism in the strain JS14 was found with 1D-PAGE and nano-liquid chromatography tandem MS/MS. With the increased expression of proteins, a noticeable change occurred in the induction of biphenyl-degrading proteins including 2,3-dihydroxybiphenyl 1,2-dioxygenase. Two detoxifying enzymes, catalase and superoxide dismutase, were up-regulated in relation to a presumable oxidative stress and during the fluoranthene metabolism. The up-regulation of chorismate synthase and nicotine-nucleotide phosphorylase may be necessary for sustaining shikimate pathway and pyrimidine biosynthesis, respectively. A heat shock protein (Hsp65) was up-regulated, whereas Hsp71 was steady during fluoranthene catabolism. The enzymes involved in biphenyl degradation may be employed to generate pyruvate and other metabolites. Strain JS14 is also capable of degrading methyl carbamate and organophosphate insecticides.

24. Antimicrobials and antibiotics: SPE considerations for UPLC-MS analysis

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UPLC requires columns packed with smaller and more rugged particles than employed for traditional HPLC. Among the benefits of this ultra high pressure technique are higher resolution and shorter analysis time. In this presentation, we will discuss two applications developed for analysis using UPLC. The determination of enrofloxacin in chicken will be considered because recent regulatory changes may dictate lower quantitation limits for this residue. A screening method for sulfonamide antimicrobials in milk will be discussed comparing UPLC with UV detection with tandem UPLC-MS. In both cases, a principal topic will be the application of mixed-mode and other SPE sorbents for isolation, enrichment and cleanup. For example, using mixed mode cation-exchange SPE and tandem UPLC-MS, a quantitation limit of 0.5 µg/kg was demonstrated for determination of enrofloxacin in chicken muscle or liver.

25. P450-mediated metabolism of tribufos defoliant and EPTC herbicide: Identification of glutathione conjugates by liquid chromatography-electrospray ionization mass spectrometry

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Formation of glutathione (GSH) conjugates from *S,S,S*-tri-*n*-butyl phosphorotrithioate (tribufos) and *S*-ethyl di-*n*-propylthiocarbamate (EPTC) was studied *in vitro* with and without metabolic activation by human hepatic cytochrome P450s and in the presence and absence of GSH and glutathione *S*-transferase (GST). Metabolites were analyzed by liquid chromatography-electrospray ionization mass spectrometry. A metabolite of tribufos exhibited a positive pseudo-molecular ion (MH^+, *m/z* 532) with a neutral loss of 129 amu, consistent with the GSH conjugate, *S,S*-di-*n*-butyl, *S*-glutathionyl phosphorotrithioate. A GSH conjugate of EPTC was also identified (MH^+, *m/z* 435). The GSH conjugates of tribufos and EPTC were formed in the presence and absence of GST, but not without microsomes, NADPH or GSH. In each case, the conjugation with GSH increased with GST. It is suggested that the GSH conjugates of tribufos and EPTC are formed via reactive sulfoxide intermediates and enzymatic glutathionylation.

26. Effect of dose on residues and disposition of an experimental ^{36}Cl-chlorate product in broilers

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Because pathogenic *Salmonella* species and *E. coli* O157:H7 have significant impacts on human health and on the food animal industry, pre-harvest intervention techniques are being pursued to control these bacteria in food animals. An experimental sodium chlorate product (ECP) consistently reduces or eliminates the number of Gram-negative pathogens in the gastrointestinal tracts of live food animals and is being developed as a pre-harvest food safety tool. The objective of this study was to determine the effect of ECP dose on the metabolism and residues of chlorate in broilers. Twelve broilers (2.69 ± 0.34 kg) were randomly allocated to three groups (n = 4 birds per group) to receive 7.5, 15.0, and 22.5 mM doses of ^{36}Cl-ECP in drinking water (500 mL) during a 48-h exposure period. Feed was withdrawn from broilers 10 h prior to slaughter and birds were killed at 54 h. The cumulative excretion of radiochlorine was 69.4 ± 8.9, 77.9 ± 25.8, and 75.5 ± 4.9% for the low, medium, and high doses, respectively. Total radioactive residues in edible tissues increased with dose in the following rank order adipose tissue ≤ white skeletal muscle < dark skeletal muscle < liver ≤ gizzard ≤ skin with adhering adipose tissue. Residues of parent chlorate were generally less than 1% of the total residue in edible tissues with chloride residues composing the balance. Tissue residues of chlorate do not appear to be a limitation in its development as a pre-harvest food safety tool.

27. Nematode control and characteristics of fosthiazate, a methyl bromide alternative

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Fosthiazate, O-ethyl S-(1-methylpropyl)(2-oxo-3-thiazolidinyl)phosphonothioate, is a member of the organophosphate class of chemistry containing a unique thiazolidine ring substituent. Fosthiazate demonstrates excellent nematicidal activity, controlling nematodes both by contact and through ingestion of treated plant parts. Fosthiazate also suppresses some insect pests for up to 45 days following application. Although its mode of action is considered to be similar to other organophosphate pesticides, namely by cholinesterase inhibition, fosthiazate itself is only a weak cholinesterase inhibitor in laboratory *in vitro* studies. Fosthiazate is registered for nematicidal control in several countries in Europe, as well as in Asia and Latin America, and was granted an USEPA registration for nematode control in tomatoes as a methyl bromide replacement in 2004. Other crop uses under review or consideration are potatoes, peanuts, bananas, coffee, caneberries, grapes, strawberries, and Easter lilies. The unique chemistry of fosthiazate contributes to its relatively low human and non-target avian and aquatic toxicity, which positions it favorably for use as a methyl bromide replacement. Unlike methyl bromide, fosthiazate is not a fumigant, but degrades in soil rapidly through a series of metabolites that result in a significant percentage of the residue being completely mineralized. Fosthiazate is supported by many grower organizations as an effective nematode control agent that can be used in an integrated pest management program.

28. Comparison of chloropicrin response thresholds with treatment levels shows low likelihood of adverse effects

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Standard 90-day and chronic mammalian testing shows that repeated-dose inhalation of chloropicrin produces respiratory tract irritation at 100 ppb (0.67mg/m^3) or above. Reproductive fitness is not adversely affected by chloropicrin inhalation even at systemically toxic levels and the developing fetus is not a target for chloropicrin. Six long-term bioassays have been completed, all with no findings of a carcinogenic effect. In humans, chloropicrin vapor behaves as a mild irritant at concentrations between 75 and 150 ppb. Effects at this level occur mainly in the eye and are mild and transient. For about 90% of the general population, exposure to 75 ppb chloropicrin or lower will not lead to eye or nose irritation. Exposures at concentrations above this (up to 150 ppb) would not lead to more than mild, reversible eye irritation.

29. Propylene oxide as an alternative to methyl bromide for strawberry fumigation

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Propylene oxide is an industrial chemical which is registered for use as a stored product fumigant. It has several properties which make it an attractive alternative to methyl bromide for strawberry fumigation. This talk will present an introduction to propylene oxide, focus on efficacy results, as well as review the likely environmental fate for PPO when used for this purpose.

30. Nematicidal activity of free fatty acids and furfural metabolites

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Many of the commercial synthetic nematicides have been eliminated from the market due to their environmental problems or their effects on human health. With the new restrictions on the use of methyl bromide for nematode control, it becomes important to search for other chemical alternatives for controlling nematodes. Based on our early published work and a recent report on the nematicidal activity of furfural, we conducted a comparative evaluation of nematicidal activity of free fatty acids and related furfural metabolites. Thirty chemicals were examined for their nematicidal activities against a group of plant-parasitic nematodes and a group of free-living and predacious nematodes. Most of the fatty acids that were bioassayed showed significant nematicidal activity, and further demonstrated that the nematicidal activity of furfural may be due to its degradation products. The results indicated that plant-parasitic nematodes are more susceptible to the tested chemicals than the free living-nematodes.

31. Methyl bromide alternatives for forest tree nurseries

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A majority of forest tree nurseries in the USA have relied on soil fumigation with methyl bromide (MeBr) to control soil-borne plant pathogens, weeds, and parasitic nematodes. Since the announcement of the scheduled MeBr phase-out, a number of nurseries throughout the United States have participated in research programs on MeBr alternatives. Despite progress on identifying suitable alternative fumigants such as dazomet, metam sodium, and chloropicrin, critical use exemptions (CUE) are being granted on annual basis for forest tree seedling production. In this presentation, we will review and discuss some of the recent findings on MeBr alternative fumigants including the methyl isothiocyanate (MITC) precursor chemicals and chloropicrin in forest tree nurseries. In addition to pest control efficacy, we will discuss the environmental fate, emission, and soil distribution patterns of these potential alternative fumigants when applied in forest nursery soils.

32. A probabilistic model for estimating bystander inhalation risks following fumigant applications

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There is currently significant regulatory interest in estimating exposures and risks to bystanders following applications of soil fumigants. Soil fumigants are generally volatile and some of the fumigant mass will escape the field causing downwind exposures to resident populations. The U.S. EPA and California Department of Pesticide Regulation are currently considering implementing buffer zones for many of the fumigants. These buffer zones would provide a restricted-entry zone around fumigant applications to mitigate potential exposures. This presentation describes a probabilistic dispersion modeling application that has been developed to address this issue. The Probabilistic Exposure and Risk model for FUMigants (PERFUM) adapts EPA air dispersion algorithms to develop probabilistic estimates of acute exposures to bystanders following fumigant applications for fields of up to 40 acres. The model considers the potential variability in exposures caused by differences in mass emission rates of the fumigants and the meteorological conditions following the application. PERFUM also outputs the probabilistic exposures both based on the whole population surrounding the field and for the maximally exposed location only. Recent additions to the model include algorithms for modeling commodity applications. The model is non-proprietary and publicly available. In this presentation, we will describe some results of the model for different fumigants and describe the latest model developments in this evolving process.

33. Recent refinements in the fumigant emissions model (FEMS)

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FEMS is one of the models reviewed and accepted by the EPA Science Advisory Panel (SAP) at the hearings held in August of 2004. There have been a number of important refinements made to FEMS based on the recommendations of the SAP, and the California Department of Pesticide Regulation. The most critical change was the incorporation of the CALPUFF model into FEMS as an optional alternative to the standard ISCST3 model. CALPUFF is the EPA recommended model of choice for complex wind conditions, including representing near-calm and calm conditions, which are critical to the establishment of buffer zones for agricultural fumigants. CALPUFF is very important to the creation of supportable buffer zones because the ISCST3 model performs at its worst during light wind speeds/calm nocturnal periods that are on the critical path in the computation of buffer zones. Through the incorporation of CALPUFF, registrants and regulatory agencies have the benefit of relying on current EPA recommended modeling procedures to address the complexity that is added by light wind speeds and calms. This presentation will compare buffer zones based on the use of the standard ISCST3 dispersion model versus FEMS/CALPUFF. The comparisons will be hypothetical in order to protect confidential data. Recommendations will be made in this presentation on designing future field studies to be consistent with the options available through CALPUFF.

34. Fungicide biochemistry and molecular biology: Past, present and future

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Most crop diseases are caused by viruses and microorganisms that have evolved specifically to infect living plants. Fungal phytopathogens are among the major constraints in crop production, particularly in a genial and humid climate like that of eastern Asia. Thus, precautions to control the plant diseases have long been used in this region; inorganic compounds such as copper oxychloride and sulfur were used initially, followed by the conventional organic fungicides, such as, methyl bromide, dithiocarbamates, and organophosphorus compounds. Since the action mechanism of these fungicides is nonspecific, they sometimes exerted undesirable side effects on non-target organisms and the environment. Thus, the modern fungicides have been developed to have no such adverse effect on non-target organisms; nonfungicidal disease controlling agents such as melanin biosynthesis inhibitors are typical examples of these chemicals. Most of the fungicides of microbial origin are also highly specific to the target plant pathogens and biodegradable in the environment. The biochemistry and molecular biology of these chemicals will be discussed focusing on the control of rice blast disease. The outstanding research contributions of many co-workers in The Institute of Physical and Chemical Research (RIKEN) are greatly appreciated.

35. *Fusarium* head blight in cereal crops: Biotechnological approaches for prevention of mycotoxin contamination

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Fusarium head blight (FHB) is a devastating disease of important cereal crops resulting in significant yield loss and mycotoxin contamination. Persistent outbreaks of FHB in Europe and North America have led to various efforts to understand the mechanisms of resistance to this disease and mycotoxin biosynthesis. For prevention of mycotoxin contamination, there are several biotechnological approaches whose concepts are simple and clear, but quite difficult to achieve; that is *(1)* breeding *Fusarium* resistant cereal crops, *(2)* suppressing toxin production, and *(3)* detoxification of mycotoxin *in planta*. We have been working with these three concepts, particularly focusing on the second approach with trichothecenes and third approach with zearalenone. In this symposium, we summarize basic and applied studies conducted in our laboratory into reducing mycotoxin contamination in FHB. *The research was supported by the Program for Promotion of Basic Research Activities for Innovative Biosciences (PROBRAIN), MAFF, Japan.

36. Studies on disease responses in rice plants by plant defense activators

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Probenazole (3-allyloxy-1,2-benzisothiazole-1,1-dioxide, provided by Meiji Seika Kaisha Ltd. as Oryzemate®) has been used to protect rice against rice blast disease since 1975. In recent years, it has been applied in about 30% of paddy fields in Japan. As probenazole treatment is highly effective in inducing disease resistance in rice plants while having no notable effect on the growth or virulence of rice blast fungus, it is referred to as a plant defense activator. In the 1990s, BTH (S-methyl benzo-1,2,3-thiadiazole-7-carbothioate, provided by Syngenta as Bion®) was developed as a plant defense activator with a similar mode of action. Since plant defense activators have been presumed to utilize an innate immune system in plants, our group has mainly investigated the responses in rice plants by probenazole in order to examine the defense mechanism in the rice-blast fungus pathosystem. Here I will discuss the results of the studies conducted on disease responses in rice plants.

37. Foliar application of a plant activator could be an alternative to soil fumigation for control of soilborne plant pathogens

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Soilborne diseases, such as tomato wilt caused by the fungus *Fusarium oxysporum* f. sp. *lycopersici*, are important biotic constraints in sustainable crop production systems. Preplant soil fumigants including methyl bromide are used extensively to protect crops from soilborne pathogens. Alternative methods for controlling soilborne diseases are desired to replace methyl bromide while maintaining high levels of disease control. Validamycin A (VMA) is an aminoglucoside antibiotic used for the control of rice sheath blight caused by *Rhizoctonia solani*. We found that foliar application of VMA or validoxylamine A (VAA) effectively controlled tomato wilt. VMA and VAA have no direct antifungal activity against *F. oxysporum* f. sp. *lycopersici*. Plants sprayed with VMA or VAA accumulated salicylic acid and had elevated expression of the systemic acquired resistance (SAR) marker genes *P4* (PR-1), *Tag* (PR-2), and *NP24* (PR-5). Foliar spray of VMA also controlled bacterial wilt (caused by *Ralstonia solanacearum*), late blight (*Phytophthora infestans*), and powdery mildew (*Oidium* sp.) of tomato. These results suggest that VMA and VAA are plant activators. Foliar application of plant activators may be a viable alternative to soil fumigation to control soilborne diseases.

38. Function of brassinosteroids in plant diseases

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Brassinosteroids (BRs) belong to a class of plant steroids showing hormonal regulation of plant growth and development and have been found to induce disease resistance in plants. A remarkable feature of BRs is their potential to increase resistance in plants to a wide spectrum of stresses, such as abnormal temperatures, drought, high salt, and pathogen attack. Analyses of BR signaling pathways and BR gene-regulating properties indicate that there are cross-talks between BRs and other hormones, including those with established roles in plant defense responses such as abscisic acid, jasmonic acid, and ethylene. Recent studies on the modulation mechanism of BRs in stress responses suggest that complex molecular changes underlie BR-induced stress tolerance in plants. Investigation on this system should generate exciting results in the future and clarify whether or not the ability of BRs to increase plant resistance to a range of stresses lies in the complex interactions of BRs with other hormones.

39. Role of two-component histidine kinases in stress response and fungicide resistance in filamentous fungi

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Two-component signal transduction pathway plays an important role for osmotic response in fungi. The mutations in *os-1*-like histidine kinase genes confer resistance to iprodione in several plant pathogens. In *Neurospora crassa*, the osmotic sensitive mutants including histidine kinase *os-1*, MAPKK kinase *os-4*, MAPK kinase *os-5*, and MAP kinase *os-2* are resistant to iprodione and fludioxonil. Both fludioxonil and osmotic stress stimulated phosphorylation of OS-2 MAP kinase, expression of glycerol dehydrogenase *gcy-1* gene, and its enzyme activity. In the *os-1* mutant, OS-2 phosphorylation by fludioxonil was cancelled, but OS-2 was still activated in response to high osmotic stress. Other 9 histidine-kinase gene disruptants showed neither fungicide resistance nor osmotic sensitivity; however, the osmotic sensitivity of the *os-1* mutant was partially suppressed by the *hk3.79* disruption, but enhanced by the *hksln* and *hk3.90* disruptions. These results suggest that several sensor histidine kinases cooperate with OS-1 to adapt to osmotic stress, in contrast, only OS-1 participates in fungicide sensitivity.

40. Derivation of human toxicity reference values for methyl iodide using physiologically based pharmacokinetic (PBPK) modeling

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Methyl iodide (MeI) has been proposed as an alternative to methyl bromide as a pre-plant soil fumigant that does not deplete stratospheric ozone. In inhalation toxicity studies performed in animals as part of the registration process, three effects have been identified that warrant consideration in developing toxicity reference values for human risk assessment: nasal lesions (rat), acute neurotoxicity (rat), and fetal loss (rabbit). Uncertainties in the risk assessment can be reduced by using an internal measure of target tissue dose that is linked to the likely mode of action (MOA) for the toxicity of MeI rather than the external exposure concentration. Physiologically-based pharmacokinetic (PBPK) models have been developed for MeI and used to reduce uncertainties in the risk assessment extrapolations (e.g., interspecies, high to low dose, exposure scenario). PBPK model-derived human equivalent concentrations comparable to the animal study no observed adverse effect levels (NOAELs) were derived.

41. CALPUFF modeling of fumigation applications: Advancing the state-of-the-art in computing buffer zones

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In August 2004, the U.S.Environmental Protection Agency convened three Science Advisory Board Panels (SAP) to review air quality modeling methods proposed to compute buffer zones for agricultural fumigants. The SAP issued two very important findings related to improving the state-of-the-art in the methods: (1) a recommendation was made to rely on low threshold sonic anemometers to more appropriately collect wind data to support buffer zones during the most critical periods, i.e., low wind speed/near-calm conditions, and (2) to rely on more advanced air quality models, such as the CALPUFF model, to more accurately simulate low wind speed and near-calm conditions. These two recommendations work in concert to reduce substantiallythe uncertainty in buffer zone estimates. This paper compares, on a normalized basis, model performance using standard methods (the ISCST3 dispersion model and standard meteorological monitoring equipment) with the enhanced performance that is now possible using better meteorological monitoring equipment and a dispersion model, i.e., CALPUFF, that is suitable to address low wind speed/near-calm conditions.

42. Methyl iodide and methyl bromide as soil fumigants: Toxicology and worker exposure

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Methyl iodide (MI) has moderate acute inhalation toxicity (rat LC_{50} ~4 mg/L; LD_{50} 80-130 mg/kg/d), is a Category I eye irritant, causing permanent corneal damage, and a Category II skin irritant/mild dermal sensitizer. In rats, inhalation (12/48 hr) reduced plasma T3 and T4 by 62-90% of controls and increased TSH (2-4 fold) at 100 ppm. In rabbits, developmental toxicity LOEL/NOELs were 10 and 2 ppm (1.5 mg/kg/d) for reduced mean fetal weight (12%), with maternal NOEL, 10 ppm. The 6-hr rat inhalation NOEL was 27 ppm (38 mg/kg/d) for reduced motor activity and body temperature. In 4- and 13-wk rat studies, LOEL/NOELs were 70 and 20 ppm (20 mg/kg/d). Chronic inhalation caused rat thyroid toxicity and increased thyroid adenomas (males). These may have arisen through altered thyroid hormones but DNA methylation by CH_3^+ may have contributed. In comparison, methyl bromide (MB) has rat acute LC_{50} values ~300-500 ppm. Risk assessment used NOEL values of 40 ppm for rabbit inhalation developmental toxicity, without maternal toxicity, and 103 ppm, for dog neurotoxicity. No increases in tumor incidence were observed in 2-yr rodent studies. USEPA only considered acute exposures to MI, not intermediate and long-term exposures to applicators, and bystanders, using the maximum measured air concentration of MI for 8-hour exposure rather than an upper-bound. USEPA estimated respiratory protection with both ISCST3 and PERFUM models to calculate distributional bystander exposure to MI from studies in California, Florida, and Michigan. This analysis used California data and ICST3 for worst-case bystander exposure to MI. Buffer zones were not used, but registrant recommendations were less than 10% of those for MB. Potential community exposures to MI were estimated from monitored ambient air levels of MB as surrogates for MI. * The views are the authors' and do not necessarily reflect California EPA policies.

43. Fumigant buffer zone development studies: Fourteen years of progress

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Buffer zones are a fundamental component of the mitigation strategy to minimize acute exposure of the public to fumigants. The Department of Pesticide Regulation (DPR) has implemented or is considering buffer zones for four major fumigants: methyl bromide, metam sodium, 1,3-dichloropropene, and chloropicrin. Potential methyl bromide alternatives are also in the registration process and, if registered, may require buffer zones. Reliable estimates of fumigant flux are required to develop buffer zones. Since 1992, DPR staff has designed and reviewed soil fumigant protocols and analyzed data from soil fumigant studies. This experience has led to the development of a set of elements that increases the success of such studies. A primary objective of these studies is to estimate flux using the "back-calculation" procedure. The back-calculation procedure requires three elements: field and sampler geometry, on-site meteorological data, and measured concentrations. Each element will be discussed.

44. Quantification of iodomethane in air samples from worker exposure and environmental monitoring/flux studies following application to plots via shank injection or drip irrigation

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Iodomethane is a soil fumigant under development by Arysta LifeScience North America Corp. as an alternative to the ozone-depleting methyl bromide. PTRL West coordinated field phases and conducted analytical portions for eight field volatility studies using shallow shank broadcast flat fume injection, raised bed shallow shank injection, and raised bed drip irrigation, all employing tarpaulin covered plots. Five studies included parallel worker exposure monitoring to provide data for assessment of occupational risk while conducting specific worker tasks. Methods and results from quantification of iodomethane residues, and calculated time weighted averages of residues in air (LOD typically <1 ppb) will be presented. Method validation, storage stability, and trapping efficiency will be addressed. The overall process of coordinating the diverse segments of these studies will be described.

45. Reducing fumigant emissions using surface tarps: Field and laboratory assessments

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Increasingly stringent regulations require that emissions of fumigants to the atmosphere be reduced to protect human and environmental health. Plastic tarps used to cover the soil surface during soil fumigation vary in their effectiveness as diffusion barriers. Virtually impermeable films (VIFs) have been developed that allow very little fumigant mass transfer across the film. Laboratory and field experiments were conducted to assess the permeability of polyethylene and VIF films to fumigant vapors and their effectiveness in reducing atmospheric emissions of fumigants. Results indicated that standard high-density polyethylene (HDPE) is relatively permeable to fumigant vapors, with the permeability increasing with increasing temperature. Cumulative fumigant emissions from soil tarped with HDPE are only slightly lower than emissions from bare soil. An intact VIF tarp can drastically reduce the maximum flux and cumulative emissions of fumigants from soil. Laboratory experiments indicated that VIFs reduced cumulative volatilization by at least 60% compared with 1-mil HDPE. Field trials showed similar results. However, in partially-covered fields (bare furrows in a bedded system), flux from untarped portions of the field contributed a large fraction of the total emissions.

46. Risk trade-off between methyl bromide and alternative chemicals, and techniques for reducing emissions in Japan

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For now, chloropicrin, 1,3-dichloropropene, methyl isothiocyanate and its generators are seen as the best alternatives to methyl bromide in Japan. Restrictions on methyl bromide required intensive searches for improved technologies and alternatives to reduce emissions, while maintaining effective disease control. Predictions of atmospheric concentrations of soil fumigants in the Kanto area were estimated by AIST-ADMER (National Institute of Advanced Industrial Science and Technology - Atmospheric Dispersion Model for Exposure and Risk Assessment). The results showed that average atmospheric concentrations of 1,3-dichloropropene under no covering condition is approximately equal level to our monitoring data, and that the total area greater than the atmospheric monitoring basis of 2.5 ìg/m^3 (US EPA IRIS, Integrated Risk Information System) reached 63%. This region will not be allowed to increase 1,3-dichloropropene use utilizing the conventional, no-covering method. If growers choose to use covering materials such as PEs and VIFs instead, the total area greater than the concentration basis is estimated to decrease to 26% and 0%, respectively.

47. Synthetic pyrethroids and California surface water

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Although organophosphate insecticides (OP) have been the primary focus of California pesticide/water quality issues since the early 1990s, agricultural OP use is decreasing and urban uses have been nearly eliminated. Synthetic pyrethroids (SP) are OP substitutes and their use has steadily increased. SPs have recently been detected in both the water column and in bed sediments of agricultural and urban waterways. In bed sediments, concomitant bioassays have shown that acute *Hyalella azteca* toxicity is correlated to total SP concentrations expressed as toxic equivalents. Addressing potential SP sediment toxicity is challenging from both a scientific and regulatory standpoint due to the unique physicochemical properties of SPs and their widespread use in virtually all sectors, including urban uses. This presentation provides an overview of California SP use, SP properties relative to the general universe of pesticides, and key technical issues relevant to SP environmental exposure assessments.

48. Ecological risk characterization for the pyrethroid insecticides

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In its re-evaluation of pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), the Environmental Protection Agency (EPA) examines all significant routes of exposure. As individual pyrethroids have been re-evaluated, a distinct pattern of similarities and differences have emerged among them. The synthetic pyrethroids are characterized not only by similar environmental fate and transport properties, but also by their common toxicity endpoints. This presentation includes a discussion of these trends and presents innovative modeling approaches to estimate the exposure to aquatic organisms in waste water, fresh water, and their underlying sediments from their use in agricultural and urban environments. Also included is a discussion of potential risks to aquatic species and options for mitigating these risks.

49. Overview of pyrethroids in California surface waters: Presence, toxicity and relationships to land use

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With 300 sediment samples throughout California, all analyzed for pyrethroids and sediment toxicity to the amphipod *Hyalella azteca*, we now have a comprehensive picture of the distribution of the compounds, which members of the class are more prevalent in the environment, and their association with toxicity. In agriculture-affected water bodies, pyrethroids were present in 66% of samples and at levels associated with toxicity in 22% of samples. There is evidence from both toxicity unit analyses and Toxicity Identification Evaluations of a link between pyrethroids and observed toxicity. In those samples which were toxic, pyrethroids were likely responsible in 60% of the cases with chlorpyrifos playing a secondary role (16% of cases). A comparison will be made to urban water bodies. Though sediment quality varies dramatically among urban creeks, in some areas, sediment contamination by urban use pyrethroids and associated toxicity is considerably greater than seen in any agricultural water body.

50. Synthetic pyrethroids: Exposure, effects and risk mitigation

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The published literature on the exposure, effects, and risk mitigation of syntethic pyrethroids in surface waters has been reviewed. Exposure from agricultural sources is largely short-term in nature and edge-of-field runoff seems to be by far the most important source of entry. Concentrations detected vary between few µg/L in water up to several hundred µg/g in sediments or suspended particles. Although it is well known that sorption reduces toxicity, some studies suggest that even particle-bound pyrethroids may exhibit a certain toxicity. Under field conditions, however, avoidance reactions of mobile non-target organisms appear to be relevant processes leading to overestimation of toxicity, e.g., in *in situ* studies and no obvious responses detected at the population level. Some recent studies have highlighted the importance of aquatic vegetation in wetlands or agricultural ditches as mitigative tools for pyrethroids.

51. Pyrethroid pesticide fate and transport: An overview of key data and conceptual models describing behavior

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Synthetic pyrethroids have been the subject of extensive environmental fate and ecotoxicity studies. Existing environmental fate data has been compiled, reviewed, and published. This paper will highlight key environmental data from the perspective of aquatic ecological risk assessment. The review showed that synthetic pyrethroids generally share similar environmental properties; the most important features are the unique adsorption/desorption characteristics and the attendant environmental dissipation and degradation kinetics. Several unifying conceptual models will be presented describing important aspects of pyrethroid behavior in and transport to water bodies. These conceptual models were derived as part of a detailed problem formulation for recent US national scale ecological risk assessments and model sensitivity studies conducted by the pyrethroid working group (PWG) to address FIFRA reregistration needs. An appreciation of these fundamental processes ensures better understanding of the fate and transport of this important class of insecticides.

52. Sediment-bound pyrethroid analysis and isomerization

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The purpose of this study was to determine a rigorous extraction technique and analytical method for the analysis of sediment-bound pyrethroid pesticides and to examine partitioning and isomerization of the pyrethroid λ-cyhalothrin in an aqueous-sediment system. Method development compared sonication with soxhlet extraction and optimized GC-ECD analysis. To investigate partitioning and isomerization, reactors containing sediment and water were fortified with λ-cyhalothrin and extracted at time points ranging from 20 min to 28 days after fortification. The transformation of the enantiomeric pair contained in pure λ-cyhalothrin to a mixture of two *cis* enantiomeric pairs was observed and quantified in both the aqueous and solid phases. Isomerization of the aqueous and solid phase cyhalothrin reached steady state after 21 days of contact. Racemization of the aqueous phase λ-cyhalothrin occurred, whereas in the solid phase, only 35% of the λ-cyhalothrin isomerized. Isomerization in the solid-phase cyhalothrin was likely inhibited because it was sorbed.

53. **Phase distribution and persistence of pyrethroids in sediments**

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Phase partition and persistence determine the fate, transport, and ecotoxicological risks of a chemical in the environment. Although pyrethroids have been in use for many years, most of our knowledge on their phase distribution and persistence is limited to soils and little information is available for sediments. In addition, conventional methods for determining adsorption coefficient K_d are known to be problematic for strongly hydrophobic compounds and do not allow characterization of K_{DOC} that is considered as a key variable for regulating chemical bioavailability in aquatic systems. This first part of this presentation will provide an overview of measured K_{OC} and K_{DOC} values for a number of pyrethroid compounds, identify information gaps, and discuss the advantages of using selective detection methods for improving measurement of phase distribution coefficients. The second part of this talk will be devoted to discussion of half-lives of pyrethroids in sediments, degradation mechanisms, and the information gaps.

54. **Ethaboxam and its biological characteristics**

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Ethaboxam is the first proprietary fungicide developed and commercialized in Korea by LG Life Sciences. Ethaboxam inhibits growth of plant pathogens specifically belonging to *Oomycetes* with protective, curative, systemic and translaminar activity in. Newly developed fungicides have a similar fungicidal profile to specific target diseases and tend to have broader spectrum, safer profile to mammals and the environment or reduced risks of fungicide resistance. In the case of ethaboxam, it has a rather narrow spectrum specific to *Oomycetes* and a safer toxicological profile. Interestingly, fungicidal modes of action studies revealed that ethaboxam simultaneously inhibits cytoskeleton formation and mitochondrial respiration of *Phytophthora infestans* at low concentrations. Up to now, there have been no indications of resistance development when monitored for baseline resistance to 261 isolates of *P. infestans* in Korea and Europe and 150 natural populations of *Plasmopara viticola* collected throughout five countries in Europe for 3 years since 2000. In a selective study conducted with young vine trees artificially inoculated with natural isolates of *P. viticola* repeatedly for 10 generations in the greenhouse, there have been no changes in the sensitivity to ethaboxam among four natural populations of *P. viticola*. Furthermore, ethaboxam has not shown any cross resistance with azoxystrobin, mefenoxam, dimethomorph, and cymoxanil. Based on the study results from modes of action and resistance development, ethaboxam appears to be unlikely to develop resistance in field applications.

55. **Orysastrobin: A fungicide innovation for rice**

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Orysastrobin, (2*E*)-2-(methoxyimino)-2-{2-[(3*E*,5*E*,6*E*)-5-(methoxyimino)-4,6-dimethyl-2,8-dioxa-3,7-diazinona-3,6-dien-1-yl]phenyl}-*N*-methylacetamide, is the common name of a new QoI-fungicide for the control of leaf and panicle blast (*Magnaporthe grisea*) and sheath blight (*Thanatephorus cucumeris*) in rice. It was discovered and developed by BASF. Its biochemical mode of action is the inhibition of the mitochondrial respiration chain by binding to the cytochrome bc1 complex at the Qo site. Orysastrobin shows an excellent plant selectivity in all tested rice varieties and is root systemic with an acropetal translocation. The active ingredient is formulated in granules with optimised release patterns, suitable for either seedling box or field applications. Orysastrobin provides an outstanding, consistent, and season-long efficacy against leaf- and panicle blast and sheath blight under different environmental conditions. Orysastrobin also has a favourable toxicological and ecotoxicological profile and is safe to users and the environment. For seedling box applications, orysastrobin will be registered with 700 g a.i./ha in combination with insecticides and for field application as a solo-compound with 660 to 990 g a.i./ha.

56. **Natural product fungicides and their congeners as pharmaceuticals**

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While the stellar discovery of penicillin marked the advent of natural product anti-bacterial therapy, this event eclipsed the therapeutic properties of griseofulvin, the first systematic medicinal anti-fungal. First reported by Oxford et al (Biochem J. 33:240, 1939) as an antibiotic obtained from *Penicillum griseofulvum*, it was initially reported as a ‘curling factor' in plants. This epinasty was noted when fungal-infected leaves were treated with griseofulvin, indicating anti-mitotic properties. Griseofulvin is a unique natural product because it contains a spiro carbon in its structure. The full medicinal properties were not understood until the late 1950's. This discovery fueled the search for other natural product fungicides and their congeners either natural or synthetic. One such agent that resulted from this search is amphotericin B, reported as an isolate from *Streptomyces nodosus* in 1956. Isolated as a separable mixture of two related compounds (amphotericin A and B), test results demonstrated compound B to be more effective as an anti-fungal agent. Nystatin, a polyene anti-fungal, was isolated from a strain of *Streptomyces noursei* in the 1950s. Due to the high toxic nature of nystatin, its use is limited to topical applications. Although the azoles are not based on a natural product template, they do possess an intereting relationship with the enzyme, lanosterol 14α-demethylase, which is responsible for egosterol biosynthesis. Examples of azole anti-fungals include clotrimazole, miconazole, ketoconazole, and itraconazole. Some of the newer agents belong to the class of allylamines which were discovered as a result of random screening of a chemical inventory. These agents possess a unique mechanism of action in their inhibition of egosterol biosynthesis. Terbenafine is probably the most recognized and used anti-fungal in this sub-class of agents.

Mechanisms of action, structural relationships and other cogent points of therapeutic natural products will be presented.

57. Chemical control of plant diseases in China

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China has a population of 1.3 billion and her most fundamental and arduous task is to supply sufficient food and fiber with highly quality to her increasing population and more affluent people. However, in China crops suffer from miscellaneous pest damage including 550 pathogens every year. Chemical control is a major and instant measurement for controlling crop diseases at present, though agricultural management practice, variety resistance, and biological agents were extensively used. About 160 thousand tons of formulated fungicides making up 14 percent of the pesticide market, including almost all of active chemical groups were applied to control the major crop diseases in China annually. Not only were the tricyclazoles and jinggangmycins extensively used on rice to control blast, sheath blight and the currently-important disease false smut, but the triazoles, benzimidazoles, strobilurins, phenylamides and other fungicides were regularly used on wheat, oil crops, fruits, and vegetables for controlling wheat rusts, powder mildew, wheat scab, downy mildew, gray mould, apple ring rot, banana leaf spot diseases, and so on. Unfortunately, the resistance of pathogens to fungicides has become more severe than with other pests. Fungicide resistance management is dependent upon processed-based research on the mechanisms of resistance, the role of fungicide-resistance disease epidemics, as well as, the invention of novel fungicides. With chemical control of plant diseases and intensive farming becoming more popular in China, the need for fungicides will greatly increase in the next years, particularly those with friendly bio-characteristics and novel modes of action.

58. Recreational exposure to chlorothalonil following application to turfgrass

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As golf and related recreational turfgrass uses become more urbanized, research on direct and indirect exposures to humans, wildlife, and adjacent environments become more essential. Human exposure risks to turfgrass pesticides can be accurately assessed by knowing routes of exposure and extent of absorbed dose. The present research emphasizes dosimetry (measuring pesticide residues on cotton suits, gloves, and personal air samplers) and biomonitoring (measuring pesticide metabolites in urine) in conjunction with environmental monitoring to determine recreational golfer exposure to an insecticide, chlorpyrifos, and a fungicide, chlorothalonil. Resulting exposure estimates based on a 1 hr reentry interval following full-course and full-rate applications were significantly less than established USEPA OPP reference dose criteria. These low exposures were successfully mitigated using partial course application strategies.

59. Endocrine disrupting actions of pesticides: Approaches to assess their estrogenic actions using cell models

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Most xenobiotic estrogeniety assay methods rely on direct agonist action on the estrogen receptor (ER) to approximate their activation potential. Such methods do have drawbacks, since some ER activating pesticides are weak or non-agonistic in ligand-binding assays. This study discusses the method that detects pesticide estrogenic actions regardless of ER ligand binding ability. Using a serum-free BG-1 ovarian cell culture model as well as MCF-7 foci formation assay, we investigated the ability of several organochlorine (OC) pesticides to stimulate known estrogenic actions. We observed concentration dependent, ER-mediated cell proliferation in BG-1 as well as foci formation in MCF-7 cells. In addition, we observed up-regulation of the ERE-dependent proteins progesterone receptor and PS2. Gel-shift/EMSA studies for ERE binding further supported these OC's ERE activating abilities. All of these effects were abolished using ICI 164,384 (ICI) as well as tamoxifen. Using the same culture conditions, we tested the blocking action of growth factor antibodies for erbB2 (9G6) and insulin-like growth factor (IGF-Ab) receptors and discovered that they inhibit BG-1 proliferation (9G6: HE and ß-HCH; IGF-Ab: Endo.) This experiment confirms the existence of a possible cross-talk between ER and growth factor receptors in OC ligand-dependent activation and also validates this sensitive method for determining both ligand-dependent and independent estrogenic activity of selected pesticides.

60. Options to estimate emission rates: When to rely on ambient-based emissions and when to use on-field FLUX methods

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What is the preferred approach to estimate emission rates: (1) ambient-based networks, or (2) on-field flux methods? There is no one correct answer. The preferred method depends on the final use of the data. This paper reviews the state-of-the-art in ambient and on-field methods, providing recommendations on the optimal use of each approach. Topics to be discussed will include the recently developed forecast-based ambient monitoring design, the use of sonic anemometers and thermocouples to support on-field flux analysis, and a description based on normalized examples of the different trends shown between ambient-based and on-field methods as a function of time of day. A description will be provided of the expected reasons for the divergence that will often be observed between the on-field and ambient methods during the course of the diurnal cycle.

61. Seed-delivered disease protection

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Healthy seedling establishment is imperative in today's agriculture, given the cost of seed such as hybrid or genetically modified cultivars. The availability of soil pesticides has declined concurrently with increasing seed costs due to environmental concerns, regulatory pressure, and economic considerations. These developments have led to increased efforts to develop pesticide-based seed coatings for plant protection. The low application rates associated with seed treatments result in reduced risk for user and environment and less stringent regulatory requirements. These factors also lower costs making this technology increasingly popular with growers. Trial results of abamectin as a nematicidal seed coating for cotton and certain vegetables have demonstrated an effective protection of young seedlings against plant parasitic nematodes, as well as a reduction in nematode-promoted fungal diseases. This technology, especially in combination with potent insecticide and fungicide components, offers an environmentally safe, effective, and economically attractive plant protection tool.

62. Current situation of alternative technologies to methyl bromide for pre-plant soil fumigation in Japan

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Chloropicrin liquid is widely used with methyl bromide in monoculture vegetable productions. Special devices have been developed for liquid injection and mulch sheet coverings so that pungent odor is not released to the atmosphere. Chloropicrin and fosthiazate applied sequentially controls disease and nematodes effectively. Spray of metham sodium was found to be more effective by mixing it deep into the soil. Sequential treatment of granulated dazomet and 1,3-dichloropropene is applied where nematode populations are high. Iodomethane is under registration review for use on melon and tomato. Solarization, hot water, and soil deoxidation treatment etc. are also used. Strawberry fruit and runners are raised in a tray-rack culture system with soilless media. Tomatoes are raised by substitutes and grafting with resistant stock for soil pests. Critical uses of methyl bromide will possibly be replaced with alternatives developed in the National Management Strategy submitted to UNEP Ozone Secretariat.

63. Organic strawberry production in California

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California leads the nation in strawberry acreage, and while the conventional acreage fluctuates around 30,000 acres, the organic sector is increasing in importance and magnitude at an average of 20% per annum. This is the result of an increasing market demand for certified organic fruit nationwide, and an acceptance of regional growers to production techniques that allow for non-chemical farming. In place of soil fumigation, soil pest management in organic strawberry fields is accomplished through pre-plant selection of fields for low disease inoculum through isolation and crop rotation. Verticillium and nematode testing is conducted, along with hand removal of weeds or the use of opaque plastic mulches. Foliar pest control is done through various organically approved products such as sulfur, copper sulfate, oils, and biological control agents. Methods of improvement in organic production will be discussed, which will include the utilization of high levels of organic matter, biological control agents, and soil-less plug plants. The results from these alternative techniques will be discussed in light of the costs of conventional strawberry production technology with standard and alternative soil fumigation.

64. Progress on alternatives to methyl bromide in China

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With reformation and the development of economy, the area of protected land expanded very rapidly in China. Protected land for vegetables is about 2 million hectares and over 20,000 hectares for strawberries. Protected agriculture and intensive culture without crop rotation provide an environment in which soil-borne diseases thrive, with the result that the occurrence of soil-borne diseases and insect pests has become more and more severe. Crop yield and quality are usually affected seriously after 3-5 years of cultivation. The resulting losses are normally 20%-40% and up to 60% or without any yield if pests and diseases are not controlled. Therefore, the control of soil-borne diseases has become a prominent problem in protected crops of high economic value in China. Under financial support of UNIDO, World Bank, GTZ, and the Italian government, as well as the Chinese government, demonstrations and technologies transfer projects were implemented in China. This talk will describe the projects that were conducted. After seven years of testing, some potential and promising alternatives were screened. The methods currently being used and some of the barriers to adoption of some alternatives will be discussed, as well as the efficacy and registration status of some alternatives.

65. Sand, calcium, and high soil pH: A high-risk recipe for enhanced biodegradation

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Severe enhanced biodegradation of metam sodium (sodium N-methyldithiocarbamate) occurs in Australia in intensive horticultural production on sandy soils. It is caused by environmentally resilient spore-forming *Bacillus* and *Actinomycetes* that metabolise the resulting methyl isothiocyanate (MITC) in as little as seven hours, compared with 15 days in similar unaffected soil. The concentration x time product was reduced by 95% and reduced efficacy of pest control was demonstrated. A positive correlation has often been reported between the risk of onset or degree of enhanced biodegradation and soil pH. Bacteria are favored over fungi in alkaline soils and calcium is an important nutrient for spore-forming bacteria, enhancing their persistence. High soil pH is often naturally associated with greater calcium concentration from limestone, or artificially through adding lime to make pH agronomically desirable. In a study of the effects of soil pH, calcium concentration and application frequency on the induction of enhanced biodegradation of MITC in a sandy and a loam soil, enhanced biodegradation was induced only under a combination of high pH and calcium concentration in sandy soil.

66. Innovative approaches for soil fumigation

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An apparatus was developed for injecting soil fumigants beneath raised planting beds covered by plastic mulch without disturbing the integrity of the beds. A mixture of 1,3-dichloropropene (1,3-D) and chloropicrin (Pic) (62:35) was combined with soil solarization, virtually impermeable films (VIF), and alternating application sequences. Worker exposure to fumigants was mitigated by separating land preparation activities from the fumigant application process. Drip irrigation systems were not required for fumigating established plastic mulched beds. Fumigation under VIF dramatically improved retention of 1,3-D and Pic in the soil, reduced the survival of plant pathogenic fungi, controlled weeds, and achieved marketable yields of pepper and tomato equivalent to adjacent areas fumigated with methyl bromide:chloropicrin. Pest control was achieved at reduced fumigant application rates. Combining soil solarization with soil fumigation improved control of soilborne diseases. Weed control was improved when the fumigant application was delayed for 7 days after formation of plastic mulched beds.

67. Heat treatment as an alternative to methyl bromide space fumigation in food-processing facilities for controlling insects: Confused flour beetle, *Tribolium confusum* (Jacquelin du Val)

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The use of elevated temperatures, or heat treatment, is gaining popularity as a methyl bromide alternative for controlling insects. Time-mortality responses for the eggs, young larvae, old larvae, pupae, and adults of the confused flour beetle, *Tribolium confusum* (Jacquelin du Val), exposed to six constant temperatures between 46 and 60^{o}C and 20-22% RH were determined. Time-mortality responses of all *T. confusum* life stages increased with an increase in exposure time and temperature. Ratio tests showed that the LT$_{99}$ values among the five stages at 46 or 48^{o}C were not significantly different ($P > 0.05$) from one another. At 50, 54, 58, and 60^{o}C, the LT$_{99}$ value of old larvae was significantly greater ($P < 0.05$) than that of eggs, young larvae, and pupae. LT$_{99}$ values of old larvae and adults were not statistically different ($P > 0.05$) from one another at 50, 54, or 58^{o}C, but they were statistically different ($P < 0.05$) at 60^{o}C. Using the time-mortality data collected at the six temperatures, a dynamic model was developed to predict survival of the most heat tolerant stage (old larvae) of *T. confusum* during heat treatments. The model is based on two nonlinear relationships: (1) logarithm of survival of old larvae as a function of time, and (2) logarithmic reduction in survival as a function of temperature. The model was validated with nine data sets collected during actual facility heat treatments. The absolute deviation of the model was within 2-7% with respect to the number of larvae surviving the heat treatment, and within 2-6% with respect to time for equal larval survival at heating rates 1.12-13.24^{o}C/h.

68. Occurrence of pyrethroids in bed and suspended sediments in California

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Pyrethroid insecticides are of environmental concern because of their increasing use and high aquatic toxicity. It is only recently that pyrethroids have been detected in California despite a decade of studies designed to measure current-use pesticides in the environment. Because pyrethroids are hydrophobic (log $K_{oc} > 5$), they are predominantly found associated with sediments rather than dissolved in water. Thirteen pyrethroids are included in the analytical method used in this study, but only four (permethrin, bifenthrin, λ-cyhalothrin, and τ-fluvaliate) were detected in bed and suspended sediments. Typically, the occurrence of these pyrethroids was correlated to known applications of that compound for agricultural or urban use. However, τ-fluvalinate was detected at several sites where its use was minimal in the corresponding watershed. Despite being in a single class, pyrethroids differ in their physical-chemical properties, which results in differences in their environmental fate and/or behavior.

69. Analysis of pyrethroid pesticides in sediment and waters at part per trillion levels by modified EPA method 8270 GC/MS narrow-range scan selected ion monitoring

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Pyrethroid pesticides are now being monitored in surface waters and stream sediments as sources of environmental toxicity. There is a need for a sensitive analytical method to detect all the commercially and environmentally relevant pyrethroids and pyrethrins. An existing, commonly used EPA Gas Chromatography Mass Spectrometry (GC/MS electron ionization) method (EPA 8270) was modified using a narrow range selected ion scan, instead of the traditional full scan, to yield the necessary sensitivity to quantify pyrethroids at environmentally relevant levels in waters (low ng/L) and sediments (sub ng/g). This analytical approach does not need the multiple extract clean up procedures of ECD analysis, is not limited to halogenated pyrethroids, and provides the benefits of analyte confirmation by the mass spectra for the compounds of interest. Due to the widespread availability of the GC/MS instrumentation referenced in this method, costs for this analyses in government and commercial labs should be quite modest.

70. Bioavailability of pyrethroids in surface water and sediment

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Pyrethroids are strongly hydrophobic compounds, which suggests that adsorption to the sediment phase, suspended particles, or dissolved organic matter (DOM) will be an important process that regulates their bioavailability and thus the actual aquatic toxicity. However, the bioavailability of pyrethroids in the multi-phased aquatic environments is poorly understood. This presentation will provide an overview of our recent studies on the use of manual solid phase microextraction (SPME) and disposable polymer-coated fibers for detecting the freely-dissolved concentration of pyrethroids in aqueous and sediment samples, and the correlation between the detected free concentration and the observed bioaccumulation potential and acute toxicity in aquatic invertebrates. Our findings so far suggest that pyrethroids adsorbed to the bulk sediment, suspended sediment particles, or DOM were essentially unavailable to the test organisms. This knowledge, when used together with phase distribution coefficients, will enable us to predict the actual toxicity of pyrethroids in a multi-phased system.

71. Chemical approach for assessing bioavailability of pyrethroid insecticides in sediments

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Tenax extraction was used to assess the bioavailability of permethrin, bifenthrin, and λ-cyhalothrin in two sediments differing in their physical characteristics. Sediments were spiked with ^{14}C-labelled compounds and allowed to sit for 7 or 90 days. Bioaccumulation was determined by exposing the oligochaete *Lumbriculus variegatus* to the spiked sediments. The rapidly desorbed sediment concentration from the tenax extraction was compared to the amount bioaccumulated in the worms. Contaminant accumulation by *L. variegatus* correlated well with the rapidly desorbed sediment concentration. Further, the contaminant fraction desorbed within 6h by tenax extraction provided an equally accurate method for estimating bioavailability. In summary, both the 6h and full desorption methods provided matrix- and chemical-independent estimates of bioavailability for these pyrethroid insecticides.

72. Fate and effects of λ-cyhalothrin observed in ditch microcosms system of different trophic status and seasonality

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In Spring 2000, the fate and ecological effects of the pyrethroid insecticide λ-cyhalothrin were compared in macrophyte-dominated and phytoplankton-dominated ditch microcosms. In late summer that year, a further experiment was performed in macrophyte-dominated microcosms to study differences in effects due to seasonality. Enclosures (water volume 0.43 m^3) were placed in ditches in Renkum, The Netherlands. λ-Cyhalothrin was applied three times at one-week intervals at nominal concentrations of 0, 10, 25, 50, 100, and 250 ng/L. Treatment solutions were gently mixed into the water column. In both macrophyte and phytoplankton dominated mesocosms, λ-cyhalothrin dissipated quickly from the water column (DT_{50} < 1 day). The macroinvertebrate community responded most clearly to treatment and, as anticipated, insects and crustaceans were among the most sensitive organisms. The results of the experiments indicate that the ecological threshold levels for λ-cyhalothrin are comparable between systems of different trophic status and seasonality when initial exposure concentrations are similar.

73. Assessing the toxicity of synthetic pyrethroids to aquatic sediment dwellers

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Synthetic pyrethroids were introduced three decades ago and are used in a wide range of applications. Pyrethroid toxicity data for water-column organisms are extensive and widely available. By contrast, data from sediment toxicity studies with pyrethroids were generated relatively recently. These recent sediment toxicity data are considered in the context of the known range of sensitivities of arthropod taxa. The relative sensitivities of water-column and sediment-dwelling organisms are discussed. Interpretation of sediment toxicity data is compared to modeled exposure concentrations in sediment and pore water for use in risk characterization. The application of toxicity data to properly assess potential environmental risk from pyrethroids is complex; it includes careful consideration of a wide range of factors, e.g., bioavailability, methodology, and the relevance of test design.

74. Patterns of pyrethroid contamination and toxicity in agricultural and urban stream segments

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Pyrethroid pesticides are widely used in both agricultural and urban environments, sometimes making it difficult to determine which land use is the original source when pesticide residues are observed in surface water bodies. Salinas, California represents a major urban area in the midst of heavily agricultural surrounding land. Several streams pass through agricultural lands, then through commercial or residential sections of the city, and then reenter agricultural regions. Pyrethroid residues in sediments and toxicity to the standard testing species *Hyalella azteca* were followed as the streams passed through these areas. Regardless of the land use, every sample but one contained pyrethroids at concentrations expected to be toxic to *H. azteca*, and all samples but that one demonstrated acute toxicity when tested. There were, however, clear differences in the pyrethroid composition between the land uses with different members of the class representative of urban and agricultural stream segments.

75. Recent advances in sediment toxicity identification evaluations emphasizing pyrethroid pesticides

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Water and sediment quality assessments are conducted as part of a number of federal, state, and regional monitoring programs in California. Increasing numbers of water bodies have been placed on the Clean Water Act 303[d] list of impaired waters due to sediment toxicity, and states must develop Total Maximum Daily Loads (TMDLs) for these sites. Part of the TMDL process requires identification of the cause of impairment so that resources are applied appropriately. In the case of sediment toxicity, toxicity identification evaluations (TIEs) are the primary tools used to determine chemicals responsible for toxicity. In this study, we describe TIE techniques specifically designed to identify and confirm sediment toxicity due to pyrethroid pesticides. We present results of TIEs conducted on sediment and interstitial water spiked with single pyrethroids, pyrethroid mixtures, and mixtures containing pyrethroid and other pesticides. We illustrate the utility of these procedures with case studies of TIEs applied to ambient samples.

76. Evolution of pesticide use and regulation in agriculture

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Following many years of irregular use of inorganics and botanicals, farmers began using synthetic pesticides on their crops early in the 20th Century. These synthetics were often broad spectrum materials, including organoarsenicals, organophosphates, organochlorines, and other categories generally populated with either quite toxic or persistent chemicals and chemical mixtures. As knowledge increased of pests, principles of pest selectivity, structure-activity relationships, predicting behavior based upon physicochemical properties, detecting residues analytically, and the need for improved safeguards for agricultural workers, bystanders, and consumers of treated commodities, the current mix of chemical tools evolved, along with biologically-based alternatives to synthetics and non-chemical cultural control methods. Regulation has played key roles, in eliminating use of older chemicals, reducing levels of use and inadvertent exposures, and providing safeguards to infants/children and other sensitive populations. A perspective on this past evolution will be given as we look toward the future of pesticides in agriculture.

77. Importance of pesticides in crop production for the foreseeable future

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Synthetic chemical herbicides and fungicides are widely-used in the US to prevent yield losses due to infestations of weeds and pathogens. Despite decades of plant breeding, commercially-acceptable cultivars resistant to the pathogens that cause over 200 crop diseases have not been released. Organic growers use fungicides to protect their crops as well. Tillage and hand weeding remain the major alternatives to herbicides and are relied on by organic growers. However, for the nation as a whole, a vast expansion of the use of tillage and handweeding is not practicable, economical, or desirable. Despite the registration of numerous biopesticides for pathogen and weed control, their use is limited due to their lack of efficacy and cost in comparison to chemical pesticides. Synthetic chemical pesticides will remain the primary means for disease and weed control for the foreseeable future because they will remain the most cost-effective method of controlling pest populations.

78. IPM as a strategy for sustaining pesticide technology as a viable tool

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All farming systems use pesticides because they are effective against a diversity of pests, fast acting, useful in emergencies, and have a very low cost to benefit ratio. The difference between farming practices considered sustainable, such as certified organic production, and conventional practices, is more the kinds of pesticides allowed than use or no use of pesticides. However, whether any particular pesticide remains a viable, effective tool long into the future depends on overcoming limitations observed even before the advent of DDT. These limitations include destruction of insect natural enemies, rapid evolution of pest resistance, prolonged presence of residues beyond a growing season, and uncertainties over health effects. Many of these limitations are being overcome with the introduction of reduced risk pesticides. However, these new pesticides will only remain effective when used as part of a comprehensive integrated pest management (IPM) program that serves as decision support strategy. Following the principles of IPM, growers can use the new pesticides to achieve better integration of biological and chemical control techniques, thereby assuring long term capabilities for adequately controlling pests.

79. Challenges in pesticide management in Mali

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Problems related to pesticides in Mali are linked to their uncontrolled distribution, their irrational use, and the ignorance by most populations of the risks bound to the manipulation of these dangerous products. Another concern is the accumulation of a great stock of chemicals, especially as a result of anti-locust campaigns, that will become obsolete in the long-term. The disposal of obsolete pesticides generated at the time of the previous campaign against locusts required the financial support of the FAO and the World Bank. In order to harmonize pesticide registration within the CILSS countries (inter-state committee for combating drought in the Sahel), including Mali, the Sahelian Committee for Pesticides, unique in Africa, was created. In spite its excellent work, the follow-up of decisions in the member countries currently constitutes the weakest link of the system.

80. Trends in the use of pesticides in China

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Use of pesticides in the last 20 years is reviewed in comparison with the growth of agricultural production, especially grain production in China. The current situation of pesticide registration, production, and application in the country is analyzed with emphasis on the changes of varieties, formulations, and products of insecticides, fungicides, herbicides, microbial pesticides, and growth regulators. The influence of occurrence of various pests, changes in cropping patterns, development of technologies, such as forecasting of pests and cultivation of GMO crops, and relevant legislation/regulation for pesticide use will be discussed. The total amount of pesticide use has been reduced in China in recent years and will continue to decline in the future in accordance with the adoption of new regulations/standards, extension, and application of new technologies, education of farmers, as well as the social awareness for food safety and environmental protection.

81. Pesticide issues in Latin America

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Agricultural product exports from Latin America to the USA, the European Union and new markets have been growing since 1999. At the same time, imports and use of pesticides have been growing significantly. Sales of pesticides in the Latin America region increased 13.8% in 2004, and are projected to grow until 2009 by 5%. Some countries have been implementing new regulations on the registration of generic products following the “Pesticide Specifications” of the FAO and WHO. Also, consumer awareness of food innocuity, detentions of exports due to pesticide residues, organic production of food, GMO crops, and environmental concern, in general, are issues that right now could affect the use of pesticides in the region.

82. Emerging issues in agricultural air quality: Challenges for the agrochemical research community

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Air quality concerns related to animal and crop agriculture have emerged as a critical issue in communities across the nation. Legislative actions to limit emissions (both gases and particulate matter (PM)) from farming operations are currently being implemented with only limited information on the effectiveness of available mitigation practices. As urban areas expand into traditionally agricultural settings, new air quality challenges have emerged where ammonia and VOCs emissions from agriculture interact with NOx and SOx emissions from combustion and mobile sources to create harmful air quality conditions e.g. PMfine formation. As chemists and scientists working in agricultural research, we are challenged to address fundamental issues related to the transport, chemistry, and fate, of PM; to characterize and quantitate the sulfur, nitrogen, and hydrocarbon chemicals emitted from agricultural operations; and to understand the factors controlling key atmospheric chemical transformations involved in the development of harmful air quality conditions. This fundamental information is required to develop science-based solutions to reduce or eliminate harmful emissions of PM, VOCs, nitrogen and sulfur compounds, and greenhouse gases from crop and animal production operations. Efforts to maximize benefits and reduce detrimental effects of agricultural production must transcend disciplinary, geographic, and political boundaries, and involve physical, chemical, natural and social scientists, economists, engineers, business leaders, and decision makers.

83. Pesticide VOC emissions as an agricultural air quality concern: Predicting emissions to the atmosphere

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Pesticides are widely used for crop production, which benefits public health. However, numerous studies have also shown that agricultural use of pesticides can contribute to both atmospheric and water contamination. Pesticide movement in the soil zone and volatilization to the atmosphere is affected by many interrelated factors such as pesticide application methods, soil and environmental conditions, chemical properties and water management practices. Volatilization leads to increases in the concentration of potentially toxic chemicals and increases the VOC content of the atmosphere. USEPA has recently established a new federal 8-hour ozone standard that requires regulators to develop and submit plans to reduce near surface ozone in non-attainment areas and this may lead to restrictions being placed on pesticide use, or require expensive reformulation of pesticide products. The purpose of this presentation is to provide an overview of some of the regulatory issues facing the use of agricultural VOC (i.e., pesticides) in non-attainment areas and to describe current research efforts to improve the predictive of emissions to the atmosphere. The goal is to develop new methodology that will help to protect the environment and allow the continued use of crop protection chemicals in agriculture.

84. Regulation of ammonia from agriculture in Denmark: Concept and methodology

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Emissions of ammonia from Danish livestock farms are strongly regulated. Manure applications to the fields are restricted to take place during the growth season and within certain limits for the total load per hectare on annual basis. Farmers need to document access to fields for application of the manure. Farmers also need to apply to the local authorities to optain permits for increasing animal productions at their farm. These applications for increasing animal production are treated using an official Guideline for Environmental Impact Assessment (EIA) of the associated ammonia loads to local nature. A structural change of local authorities in Denmark is taking place in 2007, and this change will move the obligation to carry out these assessments from the current counties to the municipalities. The current guideline for making the assessment is under review. One of the aims is to make the assessment simple to perform and updated with respect to the latest knowledge about dispersion and deposition. The present paper outlines the planned methodology behind the suggested future guideline for EIA on local nature of ammonia emissions from livestock farming in Denmark.

85. Relative humidity and its effect on sampling and analysis of agricultural odorants in air

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Source and ambient air sampling techniques are seldom validated for the variability in the air matrix. Relative humidity (RH) affects both field sampling and analysis of air samples. The objectives of this study were to determine the effect of RH on the recovery and analysis of agricultural odorants using various sorbent materials. Test atmospheres were generated at ambient temperatures, variable RH (25, 50, and 80%) and variable sample volumes (2, 4, 8, 12 and 24 L of air). A custom designed sorbent tube containing Carbotrap X sorbent material performed best with quantitative recovery of all compounds at all RHs and sampling volumes tested. Tenax sorbent tubes gave quantitative results for all compounds except acetic acid. Sorbent tubes with carbon molecular sieve (CMS) material performed poorly at both 50 and 80% RH. Water management techniques such as heating sorbent tubes during sampling and dry-purging of sorbent tubes after sampling improved both analysis and sample recovery.

86. 2005 MITC residential air assessment in Franklin County, Washington

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An ambient air monitoring program was conducted in residential neighborhoods in south Franklin County, Washington in the fall of 2005 to establish baseline fumigant air emission information for methylisothiocyanate (MITC). The purpose of this program was to examine if off-target MITC emissions from current chemigation practices exceeded California EPA Reference Exposure Level (REL) and/or EPA Office of Pesticide Protection (OPP) criteria for acute and subchronic inhalation exposure. Air sampling was performed three days per week from September 26 through October 25, 2005. Time weighted averaged (TWA) MITC residue concentrations ranged from detectable (>0.03 μg m^{-3}) to 67 μg m^{-3} (22 ppb). The TWA 30-day seasonal concentration was 10 μg m^{-3} (3.3 ppb). These monitoring results suggest that MITC residential air concentrations are currently approaching and may sometimes exceed regulatory human health inhalation exposure criteria in this agriculturally important region that is now facing expansive urban development.

87. Airborne pesticide drift and community monitoring

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Airborne pesticides and corresponding inhalation exposures result from spray or dust drift during applications or from volatilization of the chemical after application. We have been working with drift-affected communities to determine the scope and magnitude of inhalation exposures to pesticide drift near sites of high pesticide use. This presentation will discuss results from several California and Washington state locations where soil fumigants and organophosphorus insecticides were found. The particular effect of vapor pressure on drift potential will be discussed. The implications of these results will be discussed in terms of human exposures, as well as potential measures for reducing exposures.

88. Mitigation practices to reduce the impacts of synthetic pyrethroids in urban and agricultural watersheds

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Dramatic increases in synthetic pyrethroid use and detection in rivers, streams, and creeks coupled with its high aquatic toxicity, emphasizes the need to develop and to research the effectiveness of Best Management Practices (BMPs) to mitigate their presence in surface runoff. Synthetic pyrethroid users must address surface water contamination by mitigating sources of suspended soil and organic sediment using both structural and non-structural BMPs. Structural BMPs effective at reducing sediment have been shown to reduce synthetic pyrethroid levels in nursery production systems. Studies are currently underway to determine the effectiveness of similar BMPs at reducing pyrethroid levels in urban landscape systems. Structural BMPs include the use of stormwater collection and infiltration devices, vegetative biofilters, and gravity filtration systems. Non-structural BMPs include pesticide safety, information on the environmental impacts of a specific pesticide, and outreach linking the importance of proper pesticide use and BMP design, implementation, and maintenance to overall watershed health.

89. Benefits of vegetated agricultural drainage ditches as a best management practice (BMP) in Yolo County, California

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Widespread contamination of California waterbodies by the orthophosphate insecticides diazinon and chlorpyrifos is well documented. While their use has decreased over the last few years, a concomitant increase in pyrethroid usage has occurred. Vegetated agricultural drainage ditches (VADD) have been proposed as a potential economical and environmentally-efficient management practice to mitigate the effects of pesticides in runoff. VADD have been effective in mitigating simulated pyrethroid runoff storm events in the Mississippi Delta; however, California poses a different scenario in timing of runoff, rainfall intensity, and ditch vegetation and soil types. This research will incorporate temporal and spatial sampling and chemical testing of water, sediment, and plants. Initial data will provide baseline information for model generation to predict necessary ditch conditions for appropriate pesticide mitigation. Such economical and environmentally-successful management practices will offer farmers, ranchers, and landowners a viable alternative to more conventional practices currently suggested by conservation organizations.

90. Development of a simulation model to evaluate, design, and implement vegetated agricultural drainage ditches as a best management practice (BMP)

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The Pesticide Research and Identification of Source, and Mitigation (PRISM) project, under the oversight of the California State Water Resources Control Board's (SWRCB), has sponsored research into evaluating the potential applicability of vegetated agricultural drainage ditches as a BMP to minimize the transport of pesticide residues in irrigation tailwater and rainfall-induced runoff to non-target areas. A numerical simulation model has been developed to assist in the design and to evaluate the efficacy of using vegetated ditches as a BMP. This presentation outlines the mechanics of the model, validation to field study data, and application of the model in farm site-specific design.

91. Pesticide loading analysis for the Sacramento River watershed

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A probabilistic modeling assessment was conducted to identify major sources of pesticide loadings to the Sacramento River and its tributaries. Five chemicals (chlorpyrifos, diazinon, diuron, paraquat dichloride, and permethrin) were selected based on volume of use, toxicity, chemical persistence and mobility, and wet-season application. Approximately 43,000 unique combinations of soil, land use, and chemical use were simulated using USEPA's PRZM model. Thirty years of historical weather data was used to represent a varying range of rainfall events. Results indicated that highest loadings occurred around tributaries and streams of major rivers within the study area. Predicted pesticide loads were concentrated within nine counties: Butte, Colusa, Glenn, Sacramento, Solano, Sutter, Tehama, Yolo, and Yuba. Areas predicted as having the highest sources may be candidates for more detailed analysis, monitoring, or mitigation.

92. Mitigation and stewardship of synthetic pyrethroid insecticides for sediment quality

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Synthetic pyrethroid insecticides are widely used in agricultural and urban settings for effective control of many insect pests. Recent testing of ambient sediment samples may be suggesting that pyrethroid products contribute to potential impairment of sediment quality in California surface water. The role of pyrethroid manufacturers in addressing mitigation and stewardship needs will be discussed, taking into consideration topics such as regulatory background, applicable sediment quality objectives, the context of multiple stressors, transport processes, mitigation options, and stewardship activities. Differences between agricultural and urban use patterns and users will also be addressed.

93. **Responding to the changing pesticide landscape: Evolution or intelligent design**

B. Clifford Gerwick III, *Discovery Research, Dow AgroSciences, 9330 Zionsville Road, Indianapolis, IN 46268, Fax: 317-337-3546, bcgerwick@dow.com*

A wide range of socioeconomic, regulatory, industrial, environmental, and technological forces are shaping the future of agriculture and crop protection. Some of these forces may hinder the discovery and development of new agricultural chemicals including generic pressure, industry consolidation, biotechnology, and the costs of product development. The rate of introduction of new chemical active ingredients for crop protection has slowed in recent years from 71 new actives during the period 1996-2000 to 38 new actives from 2001-2005. However, new opportunities for chemical technologies are being created through shifts in the pest spectrum associated with crop production, pest resistance and migration, population growth and nutritional needs, environmental and regulatory review, and the integration of biotechnological and chemical solutions. These new opportunities will be best addressed by companies that can effectively anticipate and act on these trends.

94. Applications of green chemistry to crop protection

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Thirty billion dollars worth of synthetic chemical pesticides are used annually to control pests and plant diseases on crops and in homes and gardens. While chemical pesticides are often inexpensive and highly effective, there are issues of ground water contamination, acute toxicity, non-target effects, residues, and pest resistance development. This talk will provide an overview of the global pesticide market and discuss the potential for utilization of natural products as green chemistry alternatives to chemical pesticides, following the discovery, development, and marketing of biopesticides based on microorganisms and their associated natural product compounds.

95. **Sustainable and safe use of agrochemicals: Can we do better?**

Tjaart W. Schillhorn van Veen, *The World Bank, 1818 H Street NW, Washington, DC 20433, Tschillhornvanve@worldbank.org*

Forty five years ago Rachel Carson warned the public about longterm effects of misusing pesticides. Still, too many risky chemicals are used by consumers and farm workers who are barely aware of the risk to themselves, children, pets, or the environment. The reasons include aggressive marketing, insufficient assessment of risks (i.e., agricultural versus home/garden, unintended environments, illiterate users), and emergence of a third world chemical industry. But the increasing costs of raw materials and of managing negative externalities are increasing the price and encouraging consumers to explore new approaches in pest control. The challenge for the industry is to develop safe compounds, safe application tools, and responsible marketing, i.e., a covenant with consumers that ensures disclosure of risks by an industry aiming for safe and sustainable management of pests rather than for selling more pesticides. Carson's theme, warning about exposure of the living world to man-made "senseless, brutish things" is still valid.

96. **Insecticide discovery in the "post-genomic" era**

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The publication in 2000 of the complete genome sequence of *Drosophila melanogaster* inaugurated a new era of research on insect biology. Six years later, the promise of insect genomics for the discovery of new tools for insect control remains largely unfulfilled. This presentation will assess the progress in the sequencing and accessibility of insect genomes and will consider the implications of the expanding base of genomic information on the discovery of new insecticide targets, the enhanced exploitation of known targets, and the understanding and management of resistance.

97. **Barriers to better agricultural practices with regard to pest control**

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For purposes of this discussion, “better agricultural practices” are new practices that result in increased food production, lower cost to the consumer, reduced environmental impact, and better applicator safety. More food production is necessary to feed larger populations. However, several barriers exist to adoption of new practices, including a) monetary costs related to discovery, development, and compliance with direct and indirect regulation, b) regulatory and market conditions that discourage development of new active ingredients, c) political issues, d) inevitable unfamiliarity of regulatory agencies with innovative, non-conventional approaches to pest control, e) loss of efficacious, inexpensive, and safe pesticides because of risk cup considerations, f) industry consolidation, and g) reluctance to harmonize or to increase international cooperation in regulation of pesticides. Specific examples of some of the barriers listed above will be examined.

98. **Global trends in pesticide regulation: Some proposed approaches to international harmonization**

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An overview will be given of (a) current trends in pesticide regulatory science and how that science is being applied by regulators and manufacturers; (b) how vertical integration of the pesticide industry, with contraction of new active-ingredient research to a few companies, has impacted pesticide regulation; (c) the impact of globalization of agricultural trade on national regulatory systems and resulting efforts to harmonize systems; (d) difficulties of translating systems from one nation to another, particularly for countries without well-developed regulatory bureaucracies; and (e) the special difficulties of minor-uses and minor-crops for international trade. Proposals will be made for decreasing regulatory barriers to trade while facilitating development of nation-specific regulatory systems that are protective of ecosystems and people.

99. California's toxic air contaminant program for pesticides

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California law established the state's toxic air contaminant program in 1984. The law requires the state Air Resources Board to conduct ambient air monitoring of pesticides. General population exposure is determined by monitoring conducted in several communities in an agricultural area of high historical use during a season of expected high use of a target pesticide. To evaluate acute exposure, monitoring is also conducted near a specific agricultural application of a target pesticide. Monitoring has been conducted for over 40 pesticides. California law also requires the state Department of Pesticide Regulation to use exposure data along with other information, including data on pesticide use and toxicity, and to determine whether a pesticide should be identified as a toxic air contaminant in California and whether mitigation is needed to reduce public exposure. Several pesticides have been identified as toxic air contaminants. Mitigation measures have been developed for three soil fumigants.

100. Volatile organic compounds and greenhouse gas emissions from California dairies

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Air quality in the San Joaquin Valley ranks as the worst in the country and dairies are listed as the leading source of volatile organic compounds (VOC). Several studies were conducted at UC Davis to study VOC emissions from dairy cows, waste, and feed in sealed environmental chambers and in large, dirt-floored cow pen enclosures. Our preliminary results suggest that alcohols are the main VOC compound group found on dairies. The most significant VOC sources on dairies are fresh waste and fermented cattle feed. Stored manure in drylot corrals and enteric fermentation by the cows themselves appear to be additional important sources of VOC emissions. Manure storage ponds appear to be a far lesser VOC source than previously thought. This information is urgently needed by the $4.6 billion, 1.7 million-cow California dairy industry -- the largest in the world -- as dairy producers try to comply with strict new pollution rules.

101. Linking ammonia emission reduction and air concentrations and depositions of reduced nitrogen in Europe

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In the past decades many efforts were made reducing the impacts of atmospheric NH3 and NH4+, by developing measures to reduce (agricultural) ammonia emissions. Linking the emission reduction with monitoring of the NHx concentration and deposition is important to evaluate the successfulness of these efforts. A previous study by Sutton et al. (2001) has already addressed this subject, reviewing available measurements and modeling results from nine countries. The analysis performed there considered countries where ammonia source sector activity changed and countries where NH3 abatement policies were implemented. The study showed that linking ammonia emission changes to measurements is hampered by atmospheric interactions with other compounds (e.g. SO2). We will address this previous study, but also add information from recent national (e.g. Netherlands, UK) and international (EMEP) studies that have tried to come to a better understanding of the effectiveness of the efforts being put in the reduction of ammonia emissions.

102. Modeling ammonia with high resolution in regional scale air pollution models

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Regional and global air pollution models may be used for long-term or short time calculations such as 3-day forecasts, thus, emission inventories with high spatial and temporal resolution are needed. However, emission patterns may change over time due to national regulations, changes in population, or industrial or agricultural development. A detailed sub-sectoral ammonia emission inventory with high resolution for the European area has been developed. The inventory is linked to official reported annual total ammonia emissions for each country and coupled with a simple emission model which calculates the local temporal emission variations during the year. The model also takes into account local meteorology, agricultural management, emissions from buildings and storage, different animal types, and emissions from manure application and from plants. Here we will present and test the emission model and the inventory using the 3D-Eulerian nested air pollution model DEHM covering the European area.

103. Atmospheric transport and deposition of pesticides in Sweden

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An investigation of the possible occurrence of currently used pesticides in atmospheric deposition was preformed during 2002 - 2005 in a forested area in southern Sweden. Rainwater was collected using a bulk sampler during the most intensive spraying periods each year. Sampling was event-related which facilitated the use of back-trajectory analysis to correlate the results with the prevailing wind during the monitoring period. Pesticide residue analysis (GC-MS) includes some 80 selected pesticides and metabolites, some of which are no longer used in Sweden (LOD 0.5 - 50 ng/L). Some 40 different pesticides have been detected, with phenoxy acids, triazines, IPU, fenpropimorph, prosulfocarb and HCHs being the most commonly detected. The results show that currently used pesticides are detected in Swedish rain water, along with pesticides (n = 12) such as 2,4-D, atrazine, terbuthylazine and HCHs, which are not registered for use within the country. This indicates a transboundary atmospheric transport and deposition of airborne organic pollutants in Swedish rainfall.

104. Atmospheric levels of current-use pesticides in western Canada

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Atmospheric samples were collected at Bratt's Lake, Saskatchewan and Abbotsford, British Columbia starting in 2003 for analysis of current-use pesticides. Pesticides include organochlorines (OCs), organophosphorus pesticides (OPPs), pyrethroids, and selected fungicides/insecticides (captan, captafol, dicofol, folpet). Comparison of atmospheric levels and seasonal variations of key pesticides observed at both sites as well as pesticides with more selective use in each region will be presented. Sample extraction was completed with Accelerated Solvent Extraction (ASE) followed by concentration and/or clean-up on C18 solid phase extraction prior to gas chromatography analysis using mass spectrometry. Quantitative analysis includes gas chromatography-mass spectrometry or tandem mass spectrometry using electron impact or negative ion chemical ionization in selected ion mode (SIM) or multiple reaction monitoring (MRM).

105. Weed resistance to herbicides in North America: Herbicide classification

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Herbicides are classified in many ways but when discussing herbicide resistance, classification based on site of action is the most useful. In order to understand target-site resistance, it is essential to be able to identify the target site of a particular herbicide or herbicide class. In North America, a system has been developed that places herbicides with the same site of action within the same group. For example, herbicides that inhibit Acetyl CoA carboxylase (ACCase) are designated as Group 1 – ACCase inhibitors and herbicides that inhibit acelolactate synthase (ALS) are designated as Group 2 – ALS inhibitors. Resistance has been reported to herbicides in most of the Groups. However, resistance occurs more often with certain groups of herbicides including the ACCase and ALS inhibitors and with the herbicides that inhibit photosynthesis. In addition, the rate of resistance evolution varies greatly among the different herbicide groups.

106. Unique resistance mechanisms and challenges: Examples from waterhemp

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Waterhemp (*Amaranthus tuberculatus* and *A. rudis*) is one of the most problematic weeds of agronomic crops in the Midwestern U.S. Illustrating waterhemp's adeptness at evolving herbicide resistance, this species has evolved two different mechanisms for resistance to Photosystem II (PSII) inhibitors, resistance to acetolactate synthase (ALS) inhibitors is now the norm rather than the exception, and waterhemp was the first weed species in the world to evolve resistance to protoporphyrinogen oxidase (PPO) inhibitors. For the latter, the resistance mechanism recently was identified as an amino acid codon deletion in a gene encoding a PPO that is dual-targeted to chloroplasts and mitochondria – a sophisticated mechanism that further illustrates waterhemp's resistance proclivity. Stacking of different resistances within a single biotype is also common; in an extreme case, a single biotype is resistant to ALS, PSII, and PPO inhibitors. Most recently, waterhemp populations were identified in Missouri that likely are resistant to glyphosate. Should this resistance be further stacked in an ALS/PSII/PPO-resistant biotype, selective control of waterhemp will be extremely difficult with current herbicide options.

107. Mechanisms of weed resistance to inhibitors of acetyl-CoA carboxylase

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Acetyl-CoA carboxylase (ACCase) performs the first committed step of fatty acid synthesis, i.e., production of malonyl-CoA from acetyl-CoA. Most grasses have a homomeric form of ACCase in plastids, and this enzyme is the site-of-action for ACCase-inhibiting aryloxyphenoxypropionate, cyclohexanedione, and phenylpyrazolin herbicides. In contrast, most dicotyledonous plants have a heteromeric form of plastidic ACCase, which is not inhibited by herbicide. Decreased metabolic activation and/or increased metabolic detoxification relative to grass weeds provides herbicide tolerance to some grass crops with sensitive plastidic ACCase. While selective control of grass weeds with ACCase inhibitors remains effective in most instances, recurrent use has selected for biotypes resistant to these herbicides. Several naturally-occurring plastidic ACCase mutations have been identified as likely conferring herbicide resistance among grass weeds. Metabolism-based resistance involving detoxification enzymes is also an important resistance mechanism. The specific molecular cause of resistance in individual weed biotypes directly affects resistance magnitude for individual herbicides.

108. Target site resistance to photosystem II inhibitors in weeds

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Resistance to photosystem II inhibitors is widespread in weeds and is generally endowed by mutations in the *psbA* gene that code for altered PSII D1 protein. The resistant proteins have lower affinity for some or all PSII inhibitor classes. The most common mutation (>95% of cases) confers resistance through a Ser$_{264}$Gly substitution and has been selected mostly through use of atrazine. Other resistant weeds have mutations coding for Ser$_{264}$Thr or Val$_{219}$Ile. In algae and other organisms subjected to selection in the lab, a multitude of other mutations have been encountered. The lack of diversity in the mutations found in weeds is probably linked to the fitness cost associated with the mutations and the level of protection they confer. Interestingly, many double mutations have been documented in algae that enhance the level of resistance compared to single mutations. These double mutants have not been found in weeds yet… or have they?

109. Evolution of resistance to phytoene desaturase-inhibiting herbicides

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Compounds targeting the carotenoid biosynthetic pathway are particularly attractive because they are potent herbicides with high margins of safety to animals. Phytoene desaturase (PDS) is the most common herbicide target site in this pathway. Several herbicide classes (e.g., pyridazinones, aryloxypicolinamide, and phenoxybutanamide) inhibit PDS by competing for the binding site of plastoquinone, an essential co-factor. PDS inhibitors represent a relatively small portion of the herbicide market partly due to a lack of sufficient species selectivity. Several biotypes of the submersed aquatic weed hydrilla have become resistant to fluridone, the only herbicide approved by the USEPA for systemic treatment of large water bodies. The resistant biotypes are expected to spread and are likely to pose significant environmental challenges in the future. However, the genes encoding herbicide-resistant PDS can also be used in transgenic crops to increase crop safety margins, thus potentially expanding the marketability of these herbicides.

110. Fate and transport modeling of the potential influence of rice agriculture potential on aquaculture

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Environmental fate and transport models were used to estimate exposure concentrations of pesticide residues in potential irrigation water sources and to aquatic nontarget organisms on a probabilistic basis. Pesticide discharge from the rice paddies due to overflow or draining was simulated using RICEWQ, a pesticide water quality model for rice crops. Discharged mass of residues, predicted by RICEWQ, provided loadings to the pesticide transport model for riverine environments, RIVWQ. Concentrations were predicted in the aquatic ponds that were irrigated from a water source (canal) receiving pesticide loadings from rice paddy either by overflow or drainage. Best management practices were determined to reduce the potential concentrations in the irrigation water.

111. Characterization of carbendazim-resistant strains of *Fusarium graminearum* (wheat scab) in China

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Carbendazim (MBC) failed to control wheat scab, caused by *Fusarium graminearum* in the east of China over the last few years. MBC-resistance has developed in the pathogen population after about 30 years of the fungicide application. EC_{50} and MIC values of MBC inhibiting mycelium growth of wild-type isolates were less than 0.9 µg/mL and 1.4 µg/mL, respectively. While those inhibiting resistant collections were 7.02 - 11.86 µg/mL and more than 50 µg/mL. The slope of the MBC dosage-response curve (DRC) for resistant isolates of *F. graminearum* was flattened and different from that of other fungus. Fitness of MBC-resistance isolates was as high as sensitive ones. Most resistant strains showed intermediate resistance to MBC and positive cross-resistance to other benzimidazole derivatives except a few appeared highly resistant. It was interesting that the frequency of MBC-resistance mutation in the pathogen population was much lower than that in other fungi and the resistance resulted from the mutation of a new tubulin gene other than ß-tubulin, implying *F. graminearum* with a new target of the benzimidazoles.

112. 2005 MITC near-field air assessment; Franklin County, Washington

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Chemigation through center-pivot irrigation is the principle means of application for the fumigant metam sodium in the Pacific Northwest. Poor pre-application soil wetting and inadequate watering at application are alleged factors contributing to the off-target movement of methyl isothiocyanate (MITC), the bioactive agent of metam sodium. In the fall of 2005, MITC air concentrations were monitored near-field after the completion of a commercial chemigation in south Franklin County, WA. Air was sampled for 4-hours through charcoal adsorbent cartridges at six sampling sites spaced at approximately 60 degree around the 125-acre crop circle. The exposed cartridges were solvent extracted and analyzed by gas chromatography with nitrogen phosphorus detection. A maximum near-field MITC concentration of 150 $\mu g/m^3$ (45 ppb) was observed at a downwind sampling site. This field emission data together with emission data from a concurrent MITC residential air monitoring study lend support to the immediate need for better product stewardship practices, especially in agricultural areas that are now facing expansive urban development.

113. **Atrazine-induced hypoxic stress and regulation of hemoglobin genes in larvae of the aquatic midge *Chironomus tentans* (Diptera: Chironomidae)**

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Atrazine is an extensively used herbicide and has been routinely detected in many surface and ground waters in the United States. We used a genomics-based technique known as restriction fragment differential display (RFDD)-PCR to systematically compare gene expression profiles between atrazine-treated and –untreated (i.e., control) larvae of the aquatic midge (*Chironomus tentans*) and revealed various up- and down-regulated genes associated with hypoxic stress in atrazine-treated midges. We isolated two down-regulated hemoglobin (Hb) cDNAs from atrazine-treated midges. Northern blot analysis showed that the expression of Hb genes was significantly lower in atrazine-treated midges than that in the control following 96-h exposure. In contrast, atrazine significantly enhanced oxygen consumption in a time- and concentration-dependent manner in atrazine-treated midges. Apparently, atrazine exposure results in increased oxygen consumption, leading to a hypoxic stress in the affected midges. Our study provides insights into the physiological risk that atrazine imposes upon non-target organisms.

114. **Soil organic amendment as affecting herbicide fate**

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Addition of organic wastes to soils affects the fate of soil-applied herbicides, although it is seldom considered when making the decisions about fertilizing soil or disposing of organic wastes. The addition of organic wastes to soils can retard pesticide movement through agricultural soils; increased soil organic matter increases pesticide sorption to soil. Herbicide that is sorbed to soil particles is not instantaneously bioavailable to microoganisms, it must first desorb into solution. The objective of this work was to determine the effects of addition of organic waste from olive oil production on soil sorption-desorption, degradation, and leaching of diuron and terbuthylazine. Upon amendment with the organic residue, there was increased sorption and decreased desorbability for both herbicides in soil. Diuron persistence in soil increased upon amendment addition, whereas half-lives for terbuthylazine decreased. Leaching of both herbicides was reduced in soil columns with amendments, as compared to soil columns without amendment. The net effect of addition of olive oil production waste to soil would be to reduce leaching in soil.

115. **Use of the REMM to assess the effectiveness of buffer zones around agricultural fields to control offsite movement of a high K_{oc} pesticide**

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A high adsorption pesticide was simulated using the new 2006 version of the USDA buffer zone model, REMM. This new version of REMM has been enhanced to simulate pesticide degradation and adsorption/desorption behavior. Predicted results from a combination of the EPA model PRZM3.12 and REMM are compared with results from a site specific runoff study. The model is employed further to examine different buffer zone scenarios and to assess the effectiveness of buffer zones around agricultural fields in preventing offsite movement of the pesticide into surface waters.

116. **Analysis of adducts from reactions of herbicides with DNA bases**

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Pesticides used in crop production pose risks that include elevated stress to the plant resulting in alteration of the genome and overall degradation. From previous ^{32}P post-labeling studies, DNA extracted from crop plants after pesticide treatment yielded evidence of adduct formation with nucleotide bases. Evidence was found for both direct adducts with the pesticide, as well as indirect adducts formed with products of lipid peroxidation. The focus of this study was to investigate the susceptibility of a variety of crop plants to adduct formation from two herbicide groups, the phenoxy acids and derivatives, and the oxydim herbicides. These pesticides contain electrophilic groups which can react at nucleophilic sites of the DNA bases to form adducts. *In vitro* reactions of pesticides with nucleotide bases were performed to identify possible direct adducts. This research confirms the formation of adducts between the DNA bases and several of the herbicides investigated.

117. **Low-cost methods for reducing 1,3-dichloropropene volatilization from agricultural soil**

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Soil column experiments are being carried out to evaluate low-cost methods of reducing fumigant 1,3-dichloropropene (1,3-D) release from soil to air. A further aim of the work is to determine how well data derived from the soil columns compare with data derived from field experiments. A sandy loam soil from an experimental site previously-used to study 1,3-D volatilization in the field, is packed into stainless steel columns (12 cm diameter × 1.5 m length). Soil bulk density, moisture content and temperature are close to those observed in the field experiment. After injection at 46 cm depth, temporal trends in the release of 1,3-D from the soil surface and its distribution throughout the soil profile, are being quantified. Data will be presented for replicated volatilization-reduction treatments, e.g., surface irrigation, agricultural film coverage, chemical amendment, and organic amendment. Comparisons with data from the field study will also be made.

118. Human exposure to surface pesticide residues: Dislodgeable foliar residues and pilot studies to predict bioavailability

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Harvesters are exposed potentially to chemical residues from surfaces (TSR) via contact-transfer following crop protection. The Iwata et al. (1977) procedure for determination of dislogeable foliar residues (DFR) is standard and utilizes a weak detergent solution to wash residues from the surface of leaf samples. This chemical process contrasts with the predominantly physical contact-transfer that occurs in the field. We are investigating procedures to measure DFR and physical TSR (Transferable Surface Residue). An Automated Surface Wiper (ASW), intended to test color-fastness of textiles, automatically wipes the leaf surface with an attachment covered by cotton cloth and foil. Another device for physical surface sampling is the Benchtop Surface Roller (BSR). This machine, intended to make pasta, simulates direct worker contact with treated foliage. A cotton cloth and foil containing leaf samples is used to obtain residue. Urine biomonitoring data will be used to evaluate DFR and TSR data.

119. Potential pine seed cone harvester pesticide exposures are probably not determined by dislodgeable foliar residues

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Southern pine seed orchards are essential for establishment of pine forests. In 1998, 22,000 pounds of seed was lost to coneworms and seedbugs in the South alone. Losses to insects of 50% are not uncommon. Azinephosmethyl and phosmet have been important in orchard IPM, but registration issues including worker exposure remained. This research sought a generic transfer coefficient (TC; cm^2/h) for harvesters. Pyrethroid insecticides were advocated as replacement insecticides. Exposure, dislodgeable pine needle residues, and time worked were obtained. Needle residues were less than minimal reportable levels (~ 0.05 $\mu g/cm^2$) and became an unlikely source of harvester exposure. We biomonitored elimination of dimethyl- and dimethylthiophosphate AZM biomarkers in spot urine specimens of 13 harvesters from Texas and Louisiana who eliminated 0.1-5.3 µg AZM/kg bw-day (creatinine corrected). Unexposed controls were unavailable and low level biomarkers were probably contributed from diet and other environmental exposures. For regulatory purposes, follow-up studies will evaluate the low pesticide exposure potential of seed cone harvesting.

120. Chemical surface residues: Critical determinants of occupational and residential human pesticide exposure

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Contact-transfer of chemical residues from surfaces (TSR) potentially exposes humans in occupational and residential environments. Dislodgeable Foliar Residues (DFR; ug/cm^2) were first measured to estimate potential harvester pesticide exposure following unexplained, sporadic illnesses among California citrus harvesters. DFRs became the key determinant of safe field entry programs for hand-harvested crops. Similarly, California Food and Agriculture scientists used analogous procedures to evaluate the exposure potential of chemicals following residential use. Measurement of biphasic residue decay (pseudo first order and zero order) utilizes chemical liquid-solid, liquid-liquid extraction (DFR), or physical sampling (TSR) to estimate potential human exposures. Residues measured within hours of pesticide applications form more complete residue decay curves, but the practice may obscure the future, low level exposure potential of the chemical residues. Biological monitoring of harvesters and residents is important when evaluating environmental residue data to refine measurements of potential human pesticide exposure.

121. Persistence of pyrazosulfuron-ethyl and halosulfuron-methyl in aqueous solutions: Comparing hydrolytic dissipation

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Pyrazosulfuron-ethyl and halosulfuron-methyl are two new highly active sulfonylurea herbicides which have been widely used for weed control in many crops. Chemical hydrolysis is a primary process to determine the environmental fates of this group of pesticides. The hydrolytic dissipation of two herbicides was investigated in different pH aqueous solutions. The hydrolytic rates of both chemicals were pH dependent and accelerated at higher temperature. These results suggest that the pyrazosulfuron-ethyl is much more persistent than halosulfuron-methyl to chemical hydrolysis, although these two herbicides have similar molecular structure. Through identifying individual hydrolytic products of two sulfonylurea herbicides by LC-MS, the acidic and basic-catalyzed hydrolytic mechanisms were proposed, respectively. Additionally, the hydrolysis of two herbicides in the presence of cyclic oligosaccharides (cyclodextrins) was examined in an attempt to evaluate the effect of water-soluble hydroxyl compounds on the environmental fates of sulfonylurea herbicides.

122. Gossypol recovery and utilization from cottonseed

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Gossypol, a 2,2'-binaphthalene, is a toxic and very reactive compound from cottonseed. While producing meal and oil from the cottonseed, gossypol has not been recovered, but has been converted to a less toxic form with caustics and then added to animal feed up to an allowed amount. When the recovery of gossypol is feasible, instead of disposing in animal meal, a few byproducts may be available for commercial use. Removal of the gossypol from cottonseed by adsorption has been tested using minerals, industrial miscellas, mixtures of extraction solvents, and cottonseed crude oils. The adsorption performance data with industrial miscellas and key model compounds indicated the feasibility of gossypol recovery by adsorption. A few industrial silica and magnesium silicates with relatively high BET(Brunner-Emmer-Teller) surface areas were found useful to remove gossypol by adsorption.

123. Glyphosate metabolism in glyphosate-resistant and susceptible soybean and canola

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Glyphosate-resistant (GR) soybean possesses an insensitive 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) enzyme, the target site of glyphosate. Despite resistance, glyphosate injured certain GR cultivars under certain conditions. This may be due to phytotoxicity of aminomethylphosphonic acid (AMPA), a glyphosate metabolite. The GR soybean cultivars, AG 4603, DK 4868, and HBK 4820 treated with glyphosate (0.87 kg ae/ha) at the one- to two-trifoliolate leaf stage (21 day old) exhibited differential levels of chlorosis (HBK 4820 = DK 4868 > AG 4603). However, AMPA and shikimate levels at 14 days after treatment (DAT) were similar among cultivars. GR canola has transgenes for both glyphosate-resistant EPSPS and glyphosate oxidoreductase (GOX) enzymes. GOX catalyzes glyphosate degradation to AMPA and glyoxylate, preventing accumulation of glyphosate in canola seed. A single application of AMPA (0.25 to 8.0 kg ae/ha) reduced chlorophyll content (7 DAT) and fresh weight (14 DAT) similarly in GR (Hyola 514 RR) and glyphosate-sensitive (Hyola 440) canola.

124. Enzyme profiles in response to polycyclic aromatic hydrocarbons in *Burkholderia sp.* C3

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Cellular response to toxic chemicals in *Burkholderia sp.* C3 was studied in relation to the catabolism of the target chemicals and associated protein expressions. Differential protein profiling was performed to compare the protein profiles between the treatment and control. Proteins were separated on 1D SDS PAGE followed by in gel trypsin digestion. After extraction, the digested peptides were analyzed with nano liquid chromatography tandem MS/MS. Many specific proteins were significantly expressed after 24 hours of exposure to PAHs. Proteins that serve to protect cells from chemical stresses include chaperone protein htpG, anaerobic regulatory protein, methylenomycin A resistance protein, protease ecfE, transcriptional activator protein anr, peroxidase 69 precursor, and glutamate receptor 1.1 precursor. The proteins related to DNA and RNA repair include serine-protein kinase ATM, transcription-repair coupling factor, and multifunctional CCA protein. The enzymes associated with aromatic hydrocarbon metabolism are chloromuconate cycloisomerase cbn, 3-carboxy-*cis*,*cis*-mucomate cycloisomerase, selenate reductase ß-subunit, regulatory protein alks, and cytochrome c551 peroxidase precursor. The study of cellular response under chemical stresses is helpful to understand the regulation of gene expression at different conditions.

125. Nematicidal activity of marine algal natural products

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Organic extracts of thirteen marine algae were evaluated for their nematicidal activity. Nematodes used in the bioassay were: *Acrobeloides sp.*, *Dorylaimellus sp.*, *Mononchus sp.*, *Plectus sp.*, *Helicotylenchus sp.* and *Meloidogyne sp. Stypopodium zonale*, and *Sargassum latifolium* caused more than 90% mortality of *Meloidogyne sp.* The *S. latifolium* extract exhibited the most nematicidal activity causing at least 85% mortality in five of the six tested nematode species. *Aphelenchus sp.*, was only affected by *S. latifolium* and *Cystoseira myrica* causing 79% and 45% mortality, respectively. The egg-hatching test was conducted only on the plant-parasitic nematodes and the brown algal extracts. The majority of the brown algal extracts prevented or disrupted the embryonic-development of the eggs. The *Turbeneria triquetra* extract caused 78% hatching inhibition. The algal extracts of *Cystoseria myrica*, *Sargassum dentifolium*, and *Dictyota dichotoma* resulting in lower egg hatching of approximately 7%, 7%, and 9%, respectively.

126. Surface-modified zeolite Y for controlled paraquat release by ion-exchange process

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Zeolite Y was designed as a controlled release system for sustained release of herbicide. Paraquat (methyl viologen) was ion-exchanged into the zeolite, followed by treatment with the disilazane reagent. The surface hydroxyl groups of zeolite Y were reacted with 1,1,3,3-tetramethyldisilazane, $HN(SiHMe_2)_2$ under ambient conditions and the grafting of siloxy functionality on the zeolite was confirmed. Surface modification of paraquat-loaded zeolites encapsulates the guest molecules in the zeolite cages and release of paraquat by ion-exchange with sodium ions was studied. The total amount of paraquat released was dependent on the concentration of Na^+ in solution, and was similar for the derivatized and underivatized samples. In the absence of surface modification, equilibration occurred within 20 minutes, whereas with surface modification, the equilibration time was extended to 7 days. Paraquat was chosen as the guest molecule, since it is widely used as an herbicide and its controlled release is of interest in agricultural applications.

127. Protection of human health through safe disposal of pesticide containers in Chile

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In our experience visiting our provider farms, we have found that empty pesticide containers are not being disposed properly. Improper handling and disposal of empty pesticide containers may lead to human poisonings and environmental contamination. Some common disposal methods include: reuse for domestic purposes, burning or burying the containers, and storing the empty pesticide containers indefinitely. To help prevent improper management of empty pesticide containers, we developed an empty pesticide container-recycling program. This program was carried out in conjunction with an educational fair twice during February and May in 2006 at different locations. In February 2,431 pounds of empty pesticide containers were received from 23 farms. Thirty three percent of the total weight obtained was sent to recycling. Sixty-six percent did not meet the standards to be recycled and Frutícola Olmué S.A financed proper disposal. There are four additional events scheduled for the 2007 growing season.

128. Utilization of fungi for production of colorants

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Plant and fungi serve as a renewable source of raw material. Some produce colorants such as anthraquinones, which form the basis of many of the modern synthetic dyes. Using bio-based colorant reduces the deleterious effect of chemical synthetic processes into the environment. We have isolated several fungi which can produce colorants while growing in specific media. Dyeing fabric under different acidic and mordant dying procedures shows that these colorants have affinity to wool, silk, and nylon fabrics. We are trying to identify the structures of these colorants and classify them if they belong to a special category of textile dyes. Extraction and separation processes for purification of compounds are done by using different solvent systems, two phase separation and HPLC. Liquid Chromatography Mass Spectroscopy (LC/MS), such as Matrix Assisted Laser Desorption Ionization (MALDI) and Electron Spray Ionization (ESI), Nuclear Magnetic Resonance (NMR), and Gas Chromatography Mass Spectroscopy (GC/MS) will be used to identify the structure of these compounds.

129. Using biomimetic PDMS fibers to determine the bioavailability of pyrethroids in sediment

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Pyrethroid insecticides are widely used in both agricultural and urban regions, and their use will become even more widespread as organophosphate compounds are being phased out. Pyrethroid insecticides have broad-spectrum aquatic toxicity, including acute toxicity to benthic organisms. However, the bioavailability of pyrethroids in aquatic systems is not well understood. Because pyrethroids are highly hydrophobic, the total concentration of pyrethroids in sediment may not reflect actual biological exposure, as a significant fraction of the pyrethroids may be adsorbed to the solid phase and may be unavailable. In order to study the bioavailability of pyrethroids in sediments, disposable polydimethylsiloxane (PDMS) fibers were inserted directly into the sediment phase where they acted as biomimetic devices for the benthic invertebrate *C. tentans*. PDMS fiber ^{14}C-pyrethroid concentrations correlated well with body residue in *C. tentans*, indicating that these fibers may be good indicators of the bioavailability of pyrethroids to this species.

130. The sorption of thiobencarb to soils: Mechanistic findings

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Thiobencarb, *S*-4-chlorobenzyl diethyl(thiocarbamate), is a herbicide commonly used in rice fields worldwide to control weeds. Its mechanistic sorption processes have not been studied in detail. We examined the sorption and desorption of thiobencarb in rice agriculture and forest soils of California and to the dominant organic matter (OM) fraction (humic acid) of each soil. Results showed that thiobencarb sorption was greater to the whole soil (mineral + OM fraction) than its OM fraction alone, even though its solubility (30 mg/L) is similar to that of organic compounds having a strong affinity to humic substances (e.g., naphthalene). The structure of thiobencarb has a diethylthiocarbamate chain that is capable of distributing charge so that the molecule can bind to minerals ,whereas the chlorobenzyl component, we believe, plays a primary role in its sorption to OM. Desorption results will also be discussed. These mechanistic sorption processes are important for understanding organic chemical sorption to soils and its organic matter fraction, especially in relation to the contribution from structural components.

131. Effects of pesticide programs for cotton on soil microbial activity

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Glyphosate-based weed control systems are widely utilized; however, additional pesticides are necessary. Pesticides influence soil microbial activity, and combinations of pesticides may elicit different microbial responses. The influence of glyphosate-based cotton pest management systems on soil microbial activity and biomass was evaluated. Two soils (pasture and cultivated field) were treated with fluometuron, trifluralin, aldicarb, and mefenoxam plus PCNB with or without glyphosate. Soil microbial activity was measured by quantifying carbon (C) and nitrogen (N) mineralization. Soil microbial biomass C and N (SMBC and SMBN) were evaluated using the chloroform incubation method. Soils treated with glyphosate alone exhibited greater C mineralization 30 days after treatment than other soils. Soils treated with fluometuron, aldicarb, or mefenoxam+PCNB alone mineralized C at a greater rate than those treated with glyphosate plus the pesticides. The addition of glyphosate increased SMBC

relative to untreated soils, while responses to all other treatments were similar.

132. Indoor exposure to pyrethroid pesticides following fogger use or crack and crevice treatment by homeowners

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Pyrethroid products are extensively used in residential pest management. This study involved use of a crack and crevice spray (Air Devil™ HPX) with 0.1 % cypermethrin and a fogger (Raid Deep Reach™ Fogger) with 1.7 % cypermethrin. Families included 42 children (< 12 years old) and 52 teens/adults (≥ 12). Total µg/kg pyrethroid equivalents following crack and crevice treatment were 1.5 ± 1.1 and 0.55 ± 0.21 µg/kg for children and teens/adults after 8 days, respectively. Total µg/kg pyrethroid equivalents following fogging were 11 ± 8.3 and 2.6 ± 1.65 for children and teens/adults after 8 days, respectively. After use of foggers exposure was still above background on day 8 while after crack and crevice exposure did not increase above background on any day following application. Back-calculated exposures below known LOAELS and regulatory NOAELs for cypermethrin indicate about a 4-fold greater elimination of pyrethroid equivalents by children than teens/adults.

133. MicroRNAs: New players in plant responses to agrochemicals and environmental stress

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MicroRNA (miRNA) is an abundant class of newly identified non-coding small RNAs which play important roles in multiple biological processes, including developmental timing, signal transduction, disease, and cancer. Since initially recognized in 2002, thousands of miRNAs have been identified in animals, plants, and viruses. Recently, we developed a new approach to identify miRNAs using expressed sequence tag (EST) analysis. Using this approach, we have successfully identified more than 400 new miRNAs in 71 plant species. Based on this, we systematically studied the effect of agrochemicals and environmental stress on miRNA expression by searching the publicly available EST database. After searching more than 6 million ESTs, we observed 26% of EST contigs containing miRNAs related to different agrochemicals or environmental stresses. Of these ESTs, 22% were related to water stress, 19% related to temperature stress, and 29% related to pathogen infection. In addition, some ESTs were related to fertilizer stress or other agrochemical stress such as ABA, JA. We also observed that several miRNAs are most likely related to agrochemical stress and/or other environmental stress. Experimental studies indicate that sulfate starvation induces overexpression of miRNA 395, miRNA 402 is strongly overexpressed by dehydration, cold, salt stress, or ABA treatment, and miRNA 159 is regulated by GA. These results suggest that miRNAs play an important role in plant response to agrochemicals such as fertilizers, plant growth regulators, and pesticides, and environmental stress (cold, salinity, and drought). This finding could facilitate the design of new agrochemicals for improving crop growth and yield and allow for the testing of new agrochemicals at the molecular level.

134. Modification of polymer flocculants for the removal of atrazine from water

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Atrazine is a triazine herbicide used to control broadleaf weeds as well as some grassy weeds. It often contaminates surface water bodies through storm-water runoff. Contaminated runoff water contains atrazine sorbed to suspended solids and atrazine in solution. Commercially available polyacrylamide flocculants are effective at removing solids along with the associated sorbed phase, but not the soluble phase. This study was conducted to investigate the possibility of producing a polyacrylamide flocculant that would effectively remove both sorbed and soluble atrazine from an aqueous suspension. A polymer flocculant was created from acrylamide monomers, monomers containing trimethyl ammonium groups, and monomers containing cyclic secondary amines. The cyclic secondary amines were used to trap atrazine molecules to the new polymer through a nucleophilic aromatic substitution reaction. In tests with contaminated suspensions, significantly more atrazine was removed from solution with the new polymers compared to the commercially available polyacrylamide Magnifloc®.

135. Evaluation of essential oil mixtures for mosquito repellency

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Previous literature has documented the repellency of the catnip plant and Osage orange extracts to multiple insect pests. Investigations will focus on evaluation of mosquito repellency to essential oil mixtures containing different spatial and contact repellent activities. Mixtures consisting of essential oils from catnip (*Nepeta cataria*), Osage orange (*Maclura pomiferia*), amyris (*Amyris balsamifera*) and siam wood (*Fokienia hodginsii*), and elemol, a sesquiterpene found in Osage orange essential oil, were evaluated for repellency in a static-air bioassay against multiple mosquito species. All mixtures showed higher levels of percentage repellency as compared to the individual oils. Overall, mixtures that included monoterpenes (which provide good spatial repellency) and sesquiterpenes (which provide good contact repellency) result in excellent efficacy via both modes of action. Studies with solid-phase microextraction sampling provide support for the differences in spatial and contact repellency. Trends observed in repellency screening trials regarding structure-activity and optimization of repellent blends, including residual control, will be discussed.

136. Effects of dietary conjugated linoleic acid on European corn borer pupae and adults

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Conjugated linoleic acid (CLA) refers to a group of isomers of octadecadienoic acids with double bonds commonly at positions 9 and 11, 10 and 12, or 13 and 15. These unusual fatty acids are produced naturally in the rumen of ruminant mammals by microorganisms. Dietary CLA has been shown to alter the fatty acid profiles of hen body tissues and egg yolk lipids. CLA is thought to inhibit Δ6- and Δ9-desaturases because dietary CLA decreases monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA) and increases saturated fatty acids (SFA) in hen eggs. Hen body weight gain and rate of egg production has been shown to be affected adversely by a CLA-enriched diet. Little is known of the effects of a CLA-enriched diet on insects. A published study of dietary CLA effects on the house fly, *Musca domestica*, demonstrated CLA accumulation in body lipids with no adverse effects on development. However, we have observed that European corn borers, *Ostrinia nubilalis*, exhibit adverse effects in response to dietary CLA; they demonstrated decreased survival and an increased growth period. Our objective in this study is to examine the effect of dietary CLA on the fatty acid profile of pupa and adult corn borers. We expect to find CLA isomers in the insect tissues and altered fatty acid profiles.

137. Response of pre-spawn coho salmon to pesticides in urban streams in western Washington

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Recent monitoring suggests that pre-spawn mortality of coho salmon (*Oncorhynchus kisutch*) has increased in urban streams in Western Washington and that this mortality and pesticides in surface waters may be linked. In fall 2004, we continuously exposed green male and female coho to a chemical cocktail representative of that reported in urban streams or "clean" water and monitored their time to death, the ability of females to ripen, and effects on brain cholinesterase activity. In fall 2005, we exposed green males and females to a similar chemical cocktail for 96 h or a negative control and assessed effects on brain cholinesterase activity, sperm motility, hatching success, and growth of fry for 35 days. Results to date suggest that other factors (general water quality, habitat, or other contaminants) may be responsible for the mortality observed in the field.

138. Olfactory performance in salmonids exposed to aquatic herbicides

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Use of herbicides to control exotic or nuisance aquatic plants has been hampered by concerns of non-target effects. Little is known about sublethal effects, including the potential for impacts on the olfactory system of fishes. Olfaction is extremely important for fish influencing their ability to find mates, detect prey, and avoid predators. In anadromous salmonids, it is also part of the imprinting process allowing them to return to their natal streams to reproduce. Our objective is to determine if exposure (96 h) to four commonly used aquatic herbicides, Sonar®AS (fluridone), Reward® (diquat), Renovate® 3 (triclopyr), and DMA® IVM, (2,4-D) at their maximum application rate impacts olfactory performance of salmon smolts. Olfactory performance will be assessed by testing the smolts' ability to detect and to respond to chemicals known to elicit attraction (alanine or food extract) or avoidance (serine or skin extract). Results will be presented.

139. Examination of the fate of *Bacillus thuringiensis* Cry3Bb1 protein in a soil microcosm

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Transgenic crops expressing *Bacillus thuringiensis* (Bt) insecticidal proteins were introduced in 1996. Despite high adoption rates of commercial Bt crops, there are relatively little quantitative data concerning their environmental fate. The objectives of this study were to develop more realistic methods for examining the soil fate of transgenic Bt proteins, to measure the soil half-life of Bt Cry3Bb1 protein, to determine the importance of decomposer organisms to transgenic Bt protein degradation, and to determine the input of Bt Cry3Bb1 protein from decomposing crop residue to the soil. Soil and crop residue expressing the beetle-active Bt Cry3Bb1 protein were added to microcosms with and without the addition of three decomposing species. Conventional corn of the nearest isoline was used as a control. Replicate microcosms were removed from the study and analyzed at days 0, 5, 10, and 25. The aerobic soil half-life of transgenic Bt Cry3Bb1 protein, the significance of decomposers to Bt protein degradation in soil, and the input of Cry3Bb1 protein to soil as a result of crop residue decomposition will be presented.

140. Environmental studies on the fate of pharma proteins produced in transgenic corn

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Transgenic plants are now considered to be an effective platform for the large-scale production of recombinant pharmaceutical proteins. Although various pharmaceutical proteins are reported to be expressed in crops, their environmental effects, as well as their environmental fate and behavior are little known. In this study, I am establishing the extraction and quantification method of Cholera Toxin subunit B (CTB) protein, which can currently be expressed in corn kernels, from a soil matrix. CTB is the nontoxic (B) subunit of *Vibrio cholerae* enterotoxin and is known to induce mucosal and systemic immune reactions as a subunit vaccine. In order to optimize the extraction buffer conditions, I confirmed the extractability of bacterially expressed CTB protein from a soil matrix using five different buffers and distilled water. I also compared the extractability of a conventional test-tube shaker and a high-speed Genogrinder.

141. Environmental fate of a veterinary antibiotic: Tylosin

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The antibiotic tylosin can enter the environment through the application of organic fertilizers to farmland. The objective of this study was to investigate its environmental fate. Tylosin A, B, C, D, isotylosin 1 and isotylosin 2 were identified by HPLC/ESI-MS. Tylosin A is degraded more rapidly in light than in dark in ultrapure and pond water with dissipation half lives of 201 and 1771 days, respectively. A slight increase in tylosin B and the formation of two photo-reaction isomers of tylosin A were found under exposure to light. The stability of the photo-reaction products was also investigated. Tylosin C and D are relatively stable. In soil, tylosin A has a dissipation half-life of about 20 days, and tylosin D has a slight longer degradation half-life of about 30 days in unsterilized and sterilized soil. No biodegradation was observed at the test concentration either in pond water or in an agronomic soil. Some possible degradation pathways are proposed.

142. Proposed field study to evaluate phytoremediation and best management practices for removal of atrazine from agricultural runoff

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Atrazine non-point runoff from row crop agricultural fields has been detected in adjacent water bodies throughout the Midwest. Extensive management efforts and application rate changes have been successfully implemented to deal with runoff, but timing of rainfall events and application can overload those efforts. Several studies have demonstrated that a mixture of warm season grasses, particularly switchgrass (*Panicum virgatum L.*), can degrade and remove atrazine from the soil. Other research has shown that although buffers are effective in slowing runoff and sediment loading, they only temporarily slow atrazine movement to water bodies. We propose that altering the residence time of runoff in a switchgrass buffer would allow uptake and degradation of atrazine in runoff. Using several non-adjacent crop fields within a watershed, we are proposing a three-year study of the impacts of this approach on atrazine concentrations in the water delivered from the field. We believe altering the residence time to 24-72 hours would allow for uptake and enhanced microbial degradation. The field study will be conducted in fields with tile inlets and with a corn-soybean crop rotation. Grasses will be established the first year. Surface water monitoring will occur throughout each of three years at all locations immediately above and below the grassed areas. Grasses will be analyzed the second and third years for uptake of atrazine and key metabolites.

143. Phage-borne peptide haptens for polyclonal antibody-based heterologous immunoassay

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The development of sensitive polyclonal antibody-based competitive ELISA for the detection of small molecules frequently requires the synthesis of a series of competing haptens with lower affinities for the antibody than the target compound. The synthesis of chemically competing haptens involves the use of hazardous chemicals and procedures that are both time consuming and laborious. To overcome these disadvantages, here we report a new method that enable one to easily set up a sensitive heterologous assay with no need for the synthesis of competing chemical haptens. In this method, we used a phage peptide display technique, selected phage-borne peptide haptens which compete with target compounds (for this study, 3-PBA and DCCA-glycine, metabolites of pyrethroid insecticides), and used them for phage ELISA. The sensitivities of phage ELISAs (IC_{50} of 1.0 and 5.0 ng/mL for 3-PBA and DCCA-glycine, respectively) were superior to conventional homologous ELISAs (IC_{50}s of >150 ng/mL) and almost identical to those of chemically heterologous assays. Cross-reactivity tests showed that the use of peptide haptens did not affect the specificity of antibodies to structural homologs of the target compounds. Phage ELISAs were very robust showing little effect from of various pHs and ionic strengths and tolerance to 10% urine matrix. Good recoveries were observed when phage ELISA was applied to real urine samples spiked with analyte standard. The synthetic peptide also showed good inhibition, which indicates that the use of this peptide could be extended to different labeling or biosensor applications.

144. RIDA®QUICK Aflatoxin: A new approach for mycotoxin analysis

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RIDA®QUICK Aflatoxin, a new immunochromatographic test system, completes R-Biopharm's RIDA®QUICK product range, which is already on the market for fumonisin and deoxnivalenol testing. The innovative lateral flow test for the detection of aflatoxin shows a direct proportional result when aflatoxin is present in the sample. A test band appears when an aflatoxin concentration higher than the detection limit is determined. A control band, which develops after 2 min, ensures correct function of the test system. A semi-quantitative determination is possible which varies by incubation time and the appearance of the test line. Aflatoxin ranges of < 4 ppb, 4 ppb – 10 ppb, 10 ppb – 20 ppb and > 20 ppb can be determined. After incubation times between 5 and 16 min, the result can be detected visually. Aflatoxin contaminations in grain, corn, and additionally difficult matrices, such as nuts, figs, and pistachios, can be determined. The test kit contains 20 devices. R-Biopharm offers a wide range of products for mycotoxin analysis as enzyme immunoassays, immunaffinity columns, clean up columns, and card tests.

145. Stabilization of a ractopamine enzyme conjugate in aqueous solution, a rapid and convenient immunoassay method for the detection of ractopamine

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There is an increasing demand for a sensitive screening method for ractopamine because of the zero tolerance policy in many countries. Most of the commercially available ractopamine ELISA kits require concentrated conjugate to be diluted prior to use. We have observed that the highly diluted ractopamine HRP conjugate (1:2K) in some of the commercially available diluents cause 60-90% binding activity loss after 72hrs at room temperature. Therefore, a series of in-house formulated buffers were tested for their stabilization effect on the ractopamine-HRP conjugate. One buffer showed significant improvement on thermal stability of Ractopamine-HRP even at elevated temperature. Greater than 85% binding activity remained after 20 days at 37°C. Using this buffer, no false positives or false negatives were detected in a set of 41 blank and incurred swine urine samples. Detection limits were 0.5 ng/mL for the polyclonal based assay and 1 ng/mL for the monoclonal based assay. Both assays had cutoff concentrations at 2 ng/mL that yielded about 50-70% B/B_0. All reagents, including highly diluted ractopamine-HRP conjugate, were stable for at least one year at 4°C.

146. Compact discs as analytical platform for multi-residue immunosensing

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Currently, there is a need for setting up high-throughput, fast, sensitive, portable, and cost effective test systems to monitor pollutants continuously. A CD reader can be thought of as a laser scanner for detection of microscopic reaction products. This research relates with the development of micro-immunoassays on the polycarbonate surface of a compact disc for the simultaneous determination of 2,4,5-TP, alachlor, carbaryl, and chlorpyriphos residues in environmental waters. Compact Disc Micro-ImmunoAssays (CDµIA) were based on an indirect competitive procedure. Gold labeled immunoglobulins with silver staining were used to sense the competitive reaction, and a modified standard CD player was used as the detector. The sensitivity was in the ng/mL level with a lower amount of reagents used than with the ELISA plate format. The methodology detects 256 samples in six minutes. Our results demonstrate the enormous potential of compact discs in combination with modified CD players for parallel multi-analyte analysis.

147. Determination of clenbuterol by a portable surface plasmon resonance analyzer

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Clenbuterol has been found to be illegally used in food production. In addition to existing GC/MS or LC/MS methods, a fast screening method needed to be developed. A portable Surface Plasmon Resonance Analyzer was developed for the competitive immunochemical determination of clenbuterol in spiked porcine urine samples. The concentrations of the coating clenbuterol-BSA conjugate and monoclonal antibody were optimized. Several clenbuterol-BSA conjugate immobilization strategies were investigated and dextran mediated immobilization was found to be most efficient. The SPR detection limit for clenbuterol was calculated as 0.39 ng/mL. At 1 ng/mL level the mean recovery was 90.2% with a standard deviation of 0.14 (n = 8). The method was validated with GC/MS, and the results showed good correlations (r^2 = 0.926, with a concentration range of 0.5~15 ng/mL).

148. Novel gluten/allergen rapid testing format

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Recent US & EC legislation on mandatory allergen ingredient labelling does not cover the unintended presence of allergens. During the development of a formal Allergen Control Plan, the identification of Critical Control Points can be simplified and hastened by the judicious use of allergen/gluten tests, particularly when allied to swabbing techniques. We have developed a novel, credit-card sized test format that is easy to perform, simple to read and copes easily with extreme ranges of allergen/gluten. The GLUTEN FlowThrough (GFT) Test can detect gluten levels in foods down to about 10 - 20 ppm and in surface/environmental swabs at less than 0.25 ppm (in the swabbing solution). GFT tests take as little as 15 minutes to perform. The presence of a pink/red spot on the left (and a procedural control spot on the right) of the test area denotes a positive result. One unique feature of this format is that two separate test spots (plus a control spot) can be placed in the test area. We are employing this ability to develop a milk allergen test, for both casein and ß-LG/whey proteins, and a peanut/almond combination.

149. A portable surface plasmon resonance analyzer for the determination of ß-agonist growth promoters

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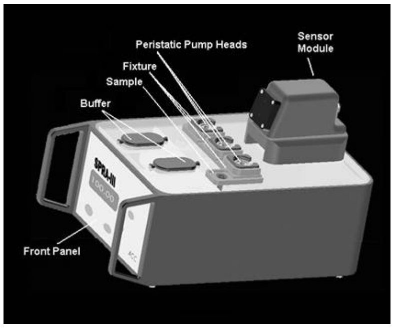
A portable Surface Plasmon Resonance Analyzer was devised based on the Spreeta^{TM} sensor from Texas Instruments, which could be applied to the determination of some ß-agonist growth promoters, such as clenbuterol and ractopamine. The analyzer was powered by a laptop rechargeable lithium ion battery, which could last for four hours of constant use. Fluid delivery was made by three peristaltic pumps. The sensor chip was integrated with a flow cell and was a plug-and-play module. Controlling software was developed with Microsoft visual C^{++}. Data acquisition was accomplished via an USB 2.0 port. The weight of the analyzer was approximately 6.6 lbs with dimensions of 200, 150, and 90 mm, respectively. Unlike other products, the analyzer is both affordable and portable for any on-site immunochemical assay.



150. Enzyme-linked immunosorbent assay (ELISA) method for monitoring 2,4-dichlorophenoxyacetic acid (2,4-D) exposures

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A streamlined ELISA method was developed to quantitatively measure 2,4-D in human urine samples. The method consisted of diluting urine samples (1:5) using phosphate buffered saline (with 0.05% Tween 20 and 0.02% sodium azide), followed by analysis in a 96-microwell plate immunoassay format. No clean up was required as sample dilution minimized urinary interferences. A multi-step sample preparation procedure was required for gas chromatography/mass spectrometry (GC/MS) analysis of the same samples. Day to day variation of the assay results was within ±20%. Overall method accuracy (70%) and precision (within ±20%) were similar between the ELISA and GC/MS methods. The estimated quantification limit for 2,4-D was 30 ng/mL based on ELISA and 0.2 ng/mL for GC/MS. The ELISA and GC/MS data were highly correlated with a correlation coefficient of 0.94 and a slope of 1.00. Results indicated that the ELISA method could be used as a high throughput, quantitative monitoring tool for identifying individuals with exposure to 2,4-D above typical background levels. NOtice: The US EPA through its Office of Research and Development funded and managed the research described here under EPA Contract 68-D-99-011 to Battelle. Although this work was reviewed by EPA and approved for publication, it may not necessarily reflect official Agency policy. Mention of trade names or commercial products does not constitute an endorsement or recommendation for use.

151. Immunological assay for BDE-47 (2,2',4,4'-tetrabromodiphenyl ether) in biological samples

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Particular attention is focused on the widespread presence of polybrominated diphenyl ethers (PBDEs) that are recently of interest to autism/children's health/neuronal developmental research. As a persistent organic pollutant, PBDEs are brominated flame-retardants often used as an additive into polymers for various household electric and electronic products. PBDEs are similar in structure to thyroid hormones and exhibit liver, neurodevelopmental, and thyroid toxicity to laboratory animals. We have developed an assay for one of the most abundant PBDE congeners (BDE-47) found in environmental and human samples. The current assay for PBDEs in buffer is highly sensitive with IC_{50} value of 3.5 µg/L for BDE-47. Concentrated sulfuric acid treatment in the liquid-liquid extraction (LLE) method or on silica gel for column chromatography that removes lipid in fat-rich biotic samples, such as serum, milk, and adipose tissue, are used as sample preparation methods prior to the analysis. To date, we used the LLE with conc. sulfuric acid to remove matrix effect in serum. The BDE-47 immunoassay using a relatively low volume (0.5 mL) of serum detected less than 1 µg/L of BDE-47 in an unspiked calf serum as an apparent concentration. Good recoveries were obtained from samples fortified in the range of 1-5 µg/L. This BDE-47 immunoassay can provide detection of around 1 µg/L BDE-47 in serum as a lower quantification limit (LOQ).

152. Controlling the spread of TSEs by diagnosis of meat and bone meals and animal feeds: Review of methods

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Controlling the spread of TSE's requires prevention of feeding infected tissues to healthy animals. Rendering and recycling animal proteins from slaughtered animals in the form of meat and bone meals is practiced because it is a good source of protein and because it saves the costs of destroying or disposing of the material. However, the practice of recycling animal proteins can result in the spread of TSEs. Determination of proper heating and of the species and tissue content of the animal proteins in rendered meat and bone meals and animal feeds present unique analytical challenges. The immunoassays available include the USDA Cooked Meat Species ELISA, the Meat and Bone Meal Thermal Evaluation ELISA, and a new method based on monoclonal antibodies raised to species troponin I. A comparison of test methods includes discussion of test characteristics that need to be considered in selecting an effective means of determining compliance with feed regulations.

153. Development of a permethrin magnetic particle-based ELISA

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Permethrin is the most widely used insecticide among the pyrethroid family. It is used in agriculture, home pest control, and in public health programs. Worldwide, the dominant use is on cotton. In the U.S., it is used on corn, wheat, and alfalfa. Permethrin has been found in streams and rivers and on produce, e.g., spinach, tomatoes, celery, lettuce, and peaches. Concerns about environmental contamination have led to the need for more rapid, sensitive, and selective methods of analysis. Enzyme immunoassays (ELISAs) have proven to be rapid, sensitive, accurate, and cost-effective methods. This paper describes the development and performance of a Magnetic Particle-based ELISA for permethrin detection in water and soil samples. The assay exhibits a sensitivity of 0.5 ppb in water with an analytical range of 0.75-15 ppb. Average recoveries in water were 98% and within and between assay precision of < 10.5%. Data obtained with soils as well as comparison to instrumental analysis will also be presented.

154. Microfluidic immunochemical ractopamine analysis

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Biocompatible-polystyrene, microfluidic cover and base chips were made by injection molding and all micro-channels were characterized by a simple and rapid 3D profile scanning method. The surfaces of the micro-channels on the base chip were processed with plasma to be more hydrophilic. A microfluidic chip workstation with an LED as the light source in the spectrometer was devised and acted as a miniaturized microplate reader. The ractopamine-BSA conjugate was pre-coated onto the surface of the chip micro-channels and determination of ractopamine was performed on the chip using competitive immunoassay. A preliminary 5 ng/mL detection sensitivity comparable to that of a conventional 96-well microtiter plate method was achieved. Further microfluidic optimization experiments were needed to improve the detection capability.

155. Multiplexed immunoassays with quantum dots as fluorescent reporters for biomonitoring of exposure to agrochemicals

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Immunoassays are used as screening tools for human exposure assessment to a variety of agrochemicals. Recently, efforts to improve immunosensing by miniaturization and introducing novel fluorescent nanostructures have gained attention. Quantum dots (QDs) are a relatively new class of fluorophores with high quantum yield, excellent photostability, and narrow photoluminescence emission. Here we present the application of QDs as labels in immunoassay microarrays for the multiplex detection of 3-phenoxybenzoic acid (PBA) and atrazine-mercapturate (AM). PBA is a biomarker of exposure to the highly potent pyrethroid insecticides and AM is a biomarker for exposure to the herbicide atrazine. Microarrays were fabricated by microcontact printing of the coating antigens in line patterns onto glass substrates. Competitive immunoassays were successfully performed using quantum dots (QD560 and QD620) as reporters. The multiplexed immunoassays were characterized by fluorescence microscopy and SEM. The application of QD fluorophores facilitates multiplex assays and therefore can contribute to enhanced throughput in biomonitoring.

156. Development of a sensitive enzyme-linked immunosorbent assay for the detection of a human urinary biomarker, 3-PBA

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Pyrethroids are widely used in agriculture as insecticides. In this study, we describe a sensitive immunoassay for the detection of PBA-glucuronide conjugate, a putative pyrethroid metabolite that may be used as a biomarker of exposure to pyrethroids. Four antisera were elicited against two different immunizing haptens. Antisera were characterized with several coating haptens. The best result was obtained with antiserum 1891 and PBA-BSA conjugate for coating giving an IC_{50} of 0.5 ng/mL. Antiserum 1891 was highly specific to the target compound with an overall CR <0.3% with tested compounds. Assay sensitivity was negligibly affected by a pH of 4-9. A five-fold improvement in IC_{50} was observed at 10X PBS with maximal absorbance almost the same as that of 1X PBS. Good recovery and correlation were observed between spike and detection levels.

157. Performance validation of the flow through rapid test and microtitre plate enzyme immunoassay test for ochratoxin A in wine using a quantitative HPLC method

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The Flow Through Rapid Test (FTRT) kit and the microtitre plate Enzyme Immunoassay (EIA) from Euro-Diagnostica BV were successfully validated at the Laboratory of Food Analysis, Ghent University, in Belgium. The FTRT and EIA test kits were used for screening red wine for ochratoxin A (OTA); the results were validated by HPLC analysis. The samples which consisted of red and rose wines were from diverse origins. The FTRT test kit contained everything required for the test. The FTRT and EIA were performed according to the manufacturer's instructions. The EIA had an average recovery of 72%. According to the FTRT screening results, 10 samples (26%) of the 38 red wine samples were positive for OTA. The HPLC confirmation showed that 21 samples (55%) were contaminated with OTA and 6 samples (16%) had levels above the 1 ppb cut-off level. Four samples (10%) gave a false positive result and there were, however, no false negative results. The Flow Through Rapid Test, therefore, had a 90% correlation with the HPLC confirmatory analysis.

158. Effects of pyrethroid insecticides on early life stages of Chinook salmon *(Oncorhynchus tshawytscha)*

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While pyrethroids have been identified as a pollution problem in sediments of the Sacramento and San Joaquin River watersheds, California, their potential effects on organisms living in the water column are largely unknown. Dissolved concentrations are generally believed to be below acutely toxic level, but there is concern that pesticides may be having deleterious sublethal effects. Our research focuses on measuring the sublethal effects of pyrethroids on different age groups of Chinook salmon, and in particular on the organism's susceptibility to disease. We quantified stress protein expression (hsp60, hsp70, hsp90), and cytokine transcription (IL-1b, TGF-b, IGF-1, Mx protein) in juvenile salmon exposed to the pyrethroid esfenvalerate alone and in combination with IHNV (infectious hematopoietic necrosis virus), an important pathogen affecting Pacific salmonids. Our results suggest that sublethal levels of pyrethroid act synergistically with IHNV to compromise health and survivorship of fish populations through immunologic disruption.

159. Solving the matrix interference problem for identification of pyrethroid insecticides by gas chromatography

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Qualification errors can occur during gas chromatography (GC) analysis because of the differential interaction of analytes with the active sites in the inlet and column between calibration standards and environmental samples. Isomerization of pyrethroids was observed during GC analysis which decreased analytical sensitivity. An improvement in sensitivity was noted for the susceptible pyrethroids in sediment extracts in comparison to non-matrix samples. This “matrix-induced response enhancement” was used to lower the detection limits for pyrethroids. Stability of the analytes in different solvents and compensation for the matrix effects with analyte protectants were investigated for qualifying pyrethroids in sediment extracts. Sugars, corn oil, blank matrix extracts, and organic acid were tested as analyte protectants. Results showed the calibration standards made in 0.1% acetic acid acidified hexane, ethyl acetate, or toluene prevented pyrethroid isomerization, increased detection sensitivity 1–4 times, and calibration curve linearity 1.6-5.2 times compared to hexane extracts alone.

160. Multi-residue method for the determination of eight synthetic pyrethroids in sediment using gas-liquid chromatography with negative ion chemical ionization mass spectrometry detection

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A multi-residue analytical method has been developed for the analysis of eight synthetic pyrethroid insecticides (bifenthrin, cypermethrin, cyfluthrin, deltamethrin, esfenvalerate, fenpropathrin, λ-cyhalothrin and permethrin) in freshwater and marine sediment samples. The method utilises gas-liquid chromatography with negative ion chemical ionisation mass spectrometry (GC-NICI) as a detection technique. The high sensitivity and high selectivity of the GC-NICI detector enable a straight forward sample preparation procedure to be used with method limits of quantitation in the sub part per billion range. The poster will describe the analytical method and present data from method validation studies.

161. Solid-phase microextraction (SPME) measurement of pyrethroids in sediment porewater

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Acute sediment toxicity of pyrethroids is expected to closely depend on the pesticide concentration in the sediment porewater. Thus, there is a need for methods that detect pyrethroids in sediment porewater with desired detection limits. Solid-phase microextraction (SPME) with GC-ECD can achieve low detection limits with small water samples, which greatly reduces the quantity of sediment porewater that has to be collected and processed. In addition, SPME selectively detects the dissolved pesticide concentration that may be mostly responsible for the observed toxicity. By comparing the concentration measured by SPME and that by the conventional liquid-liquid extraction (LLE) for the same sample, an important partition coefficient, K_{DOC}, can also be obtained. While K_{DOC} is essential for understanding the distribution of a pyrethroid between dissolved organic matter and water phases, the SPME-derived porewater concentration will likely provide a better measurement for the potential toxicity.

162. Determining the occurrence toxicity, and composition of mixtures of urban-use insecticides

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Over the last sixty years, insecticides from a number of different chemical classes have been used in both agricultural and urban settings. Organochlorine (OC), organophosphate (OP) and, more recently, pyrethroid insecticides have dominated the commercial market and have been detected together in sediment samples. The large number of chemicals often present together can confound attempts to determine the hazard posed by individual components of the mixture. The objective of this study was to analyze a pre-constructed database of chemical concentrations in sediment samples collected from streambeds receiving runoff from urban environments throughout California's Central Valley. Samples were analyzed for 28 different insecticides. A censoring approach was used to eliminate negligible compounds in order to identify mixture components that dominated sample toxicity to *Hyalella azteca*. Seven pyrethroids and chlorpyrifos were found to account for nearly all of the toxicity in a majority of samples with tertiary mixtures of pyrethroids dominating the toxicity in most cases.

163. Pyrethroid insecticides in California surface waters: Concentrations and estimated toxicity

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Pyrethroid insecticides are applied to a variety of crops in California throughout the year; over 130,000 kilograms of pyrethroid active ingredients were applied to agricultural fields throughout the state in 2004. Due to the aquatic toxicity of the pyrethroids, offsite movement of these compounds into surface water is of concern. The California Department of Pesticide Regulation conducted pyrethroid monitoring at over 40 sampling locations throughout the state over a 24-month period. Bed sediment and whole water samples were analyzed for up to 11 pyrethroid insecticides. Total organic carbon (TOC) was determined for bed sediment samples, and toxicity was estimated utilizing a toxicity unit (TU) approach. Frequently detected pyrethroids included permethrin, bifenthrin, esfenvalerate, λ-cyhalothrin, and fenpropathrin. Detailed results and interpretation of this monitoring effort will be presented.

164. Effect of temperature on the toxicokinetics of pyrethroid insecticides in *Chironomus tentans*

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Changes in temperature can have substantial effects on biological processes. While it has been shown that decreased temperature causes increased toxicity of pyrethroid and organochlorine insecticides in several species, the mechanism for this change is not completely understood. Changes in temperature can directly influence the toxicokinetic parameters of uptake, biotransformation, and elimination, and in general, these processes typically increase with temperature. The objectives of this study were to examine the effect of temperature (13 and 23°C) on the toxicokinetic parameters of the pyrethroid permethrin and compare these changes to those in the organochlorine DDT in *Chironomus tentans* larvae. Both permethrin and DDT toxicity increase with decreases in temperature, which is explained using toxicokinetics. Permethrin's increased toxicity may be due to decreased biotransformation, whereas DDT's may be attributed to slower elimination and accumulation at decreased temperatures. This research can later be used to help explain Toxicity Identification Evaluation results for pyrethroids.

165. Influences of aquatic plants on the fate of the pyrethroid insecticide λ-cyhalothrin in aquatic environments

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Aquatic exposure assessments for pesticides are generally based on laboratory studies performed in water alone or water-sediment systems. Although aquatic macrophytes can be a significant component of many aquatic ecosystems, their impact on pesticide fate is generally not included. To investigate the influence of aquatic plants on the fate and behavior of the pyrethroid insecticide λ-cyhalothrin, three laboratory experiments (to assess adsorption and degradation) and an indoor microcosm study (to assess fate under semi-realistic conditions) were conducted. In laboratory studies, adsorption to all aquatic plant species was extensive and essentially irreversible, and degradation occurred rapidly by cleavage of the ester bond. In the indoor microcosm (which contained water, sediment, and macrophytes from a pond), degradation was also rapid with DT_{50} and DT_{90} values of < 3 hours and 19 hours, respectively, for dissipation from the water column, and DT_{50} and DT_{90} values of < 3 hours and 56 hours, respectively, for the whole system, which were significantly shorter than observed in systems containing only water and sediment. For adsorptive and readily-degraded pesticides like λ-cyhalothrin, we conclude that the presence of macrophytes will have considerable influence on fate and behavior in surface waters.

166. Piperonyl butoxide as a tool to identify pyrethroid toxicity in field sediments

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Piperonyl butoxide (PBO) is a synergist used in many commercially-formulated pyrethroid pesticide products. In this study, methods were developed and validated for PBO use to identify or exclude pyrethroids as the cause of toxicity in field sediments. Pyrethroid toxicity in laboratory-spiked sediments was increased approximately two-fold in toxicity tests with *Hyalella azteca* exposed to 25 µg/L PBO, and much greater synergism was observed at higher PBO concentrations. The effect of PBO on the toxicity of several non-pyrethroids (Cd, DDT, chlorpyrifos, and fluoranthene) was demonstrated. Mixtures of the pyrethroid bifenthrin and the organophosphate pesticide chlorpyrifos were also tested to determine the ability of this technique to identify pyrethroid toxicity when organophosphates are also present in a sample. Nine field sediments with known pesticide concentrations were used to validate the PBO toxicity identification method.

167. Development of an aquatic toxicity database for synthetic pyrethroids

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The Pyrethroid Working Group conducted a review and evaluation of all available aquatic toxicity data for synthetic pyrethroids registered in the US. Data on standard test endpoints from more than 600 company-sponsored studies and open-literature publications for ten pyrethroid active ingredients were compiled into a spreadsheet database. Stringent and consistent criteria were used to evaluate every study and this allowed identification of the most reliable data for each pyrethroid. Results are summarized for each synthetic pyrethroid, taxonomic group, habitat, exposure duration, and exposure medium. Trends in the sensitivity of aquatic species to pyrethroids will be compared using Species Sensitivity Distributions. Because effect concentrations are correlated with application rate (due to efficacy), aquatic risk is likely to be similar for the synthetic pyrethroids as a class.

168. Esfenvalerate and chlorpyrifos differentially affect native Pacific Northwest aquatic insects

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We investigated how distinct life stages of native aquatic insects are differentially impacted by two neurotoxic insecticides with differing modes of action – esfenvalerate and chlorpyrifos. Due to their sensitivity to xenobiotics, native aquatic insect species are often utilized as a gauge of stream health; however, pertinent laboratory assays utilize only a few standard invertebrates (e.g., *Daphnia sp.* or *Chironomid sp.*) to evaluate acute and chronic mortality. As a consequence, little is known about impacts on diverse stream fauna and the life-stage-specific sensitivity of native organisms to insecticides. Using bioassays with field-collected Pacific Northwest native *Ephemeropterans* (mayflies) and *Trichopterans* (caddisflies), we compared the effects of low esfenvalerate and chlorpyrifos concentrations to various life stages (developing eggs and pre-emergent nymphs, late instar larvae and pupae). Toxicity was evaluated based on mortality or impaired behavior. The most sensitive life stages were the pupating caddisflies and pre-emergent mayfly nymphs.

169. National pyrethroid aquatic exposure analysis (1): Relative erosion potential summarized by watershed

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This three-part presentation describes a national aquatic exposure analysis that was undertaken to characterize watersheds across the conterminous USA for relative risk from potential pyrethroid exposure. Part 1 provides the results and methodology for the relative ranking of watersheds based on potential edge of field pyrethroid transport *via* erosion. The automated assessment relied upon databases created specifically to provide all necessary inputs for national scale PRZM3 simulation modeling. PRZM runs were conducted for each combination of soil, weather, and crop (200,000+ simulations). PRZM simulation results were assigned to each of the approximately 62,000 watersheds from the USGS Enhanced River Reach File 2 dataset. The results represent a national distribution of potential erosion exposure suitable for identifying areas for more detailed analysis. In addition, this approach permits detailed analysis results to be placed within the broader context of USA agriculture and potential surface water exposure from erosion.

170. National pyrethroid aquatic exposure analysis (2): Regional sensitivity to drift and erosion entry

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This three-part presentation describes a national aquatic exposure analysis that was undertaken to characterize watersheds across the conterminous USA for their relative potential for pyrethroid aquatic exposure. Part 2 is an examination of the relative sensitivities to pyrethroid exposure from both spray drift and erosion entry potential. PRZM and EXAMS models were used to estimate the relative contribution of drift and runoff to pyrethroid sediment loads across representative crop-regions. Two levels of sensitivity analyses were conducted. The first level generated more than 40,000 simulations for various pyrethroid/crop/drift/weather/soil/organic matter/slope length (LS) factor combinations under realistic local weather conditions. The second level examined input parameters that were not varied in the first level such as pond depth, field-to-pond ratio, and tillage. Ultimately, results from this sensitivity analysis will be applied to optimize the detailed regional and crop-specific analyses of potential pyrethroid exposures in water bodies across the USA.

171. National pyrethroid aquatic exposure analysis (3): Combining potential vulnerability from spray drift, erosion and pyrethroid use

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This three-part presentation describes a national analysis to characterize watersheds across the conterminous USA for their relative potential for pyrethroid aquatic exposure. Part 3 describes combining potential pyrethroid loadings to surface water from spray drift and erosion. Pyrethroid mass transported *via* drift was calculated for approximately 62,000 individual watersheds for four water classes. Erosion mass was calculated for all soil components in each watershed. Drift and erosion pyrethroid contributions were estimated using three methods: a conservative one in which the entire contributing area was cropped and treated, another in which only cropped areas contributed mass, and a third in which only cropped and treated areas could generate pyrethroid mass. This generated a distribution of total potential pyrethroid exposure suitable for identifying areas for detailed analysis. It also permitted detailed site-specific exposure analyses to be placed within the broader context of US agriculture and potential surface water exposure.

172. Method for calculating the USLE LS-factor for erosion risk assessments in large watersheds

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Runoff losses of pesticides are a function of the magnitude of the erosion, particularly for pyrethroids. A GIS-based method for estimating the length-slope factor (LS) of the Universal Soil Loss Equation was developed. The LS-factor, referred to as the topographic factor, is highly variable, making spatially-explicit estimates critical for spatial assessments of soil erosion. The method developed draws from previous work while contributing several new approaches. The result is a method applicable to large watersheds using readily available high-resolution topographic and land cover datasets. The method was applied to over 300 HUC8 agricultural watersheds in the Midwest. The results were validated by comparing the GIS-based distribution of LS-factor values with the distribution calculated from the Natural Resources Inventory database at the 8-digit watershed level. This approach to spatially-explicit calculation of the LS-factor is a step towards assessments of erosion and agrochemical exposure for strongly sorbed compounds like pyrethroids.

173. Runoff potential of esfenvalerate from a prune orchard with managed floors

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Synthetic pyrethroids, including esfenvalerate, are increasingly used in California during the dormant season in stone fruit and nut orchards as a replacement for diazinon. Monitoring data for evaluating potential off-site movement of dormant season pyrethroids from orchards are sparse. This study tested the rainfall runoff potential of esfenvalerate in a 300-acre prune orchard with managed floors. The study was designed to quantify within-orchard whole water esfenvalerate runoff concentrations and to determine if the concentrations were significantly different for two different floor management treatments. Treatments included a perennial sod cover crop and bare ground in row middles. Samples were also taken to determine off-site concentrations in whole-water samples from an adjacent drainage ditch and holding pond that received runoff water from the orchard. Post application runoff concentrations from two storm events ranged from 0.103 to 5.39 ppb. Suspended sediment concentrations in runoff samples ranged from 0.01 to 0.60 g/L.

174. Reduction of pyrethroid runoff from a commercial nursery

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Pesticides in nursery runoff are an important source of contamination for surface water streams in many urban regions. Improvement of water quality demands mitigation practices for reducing pesticide export from nurseries. We carried out studies to understand runoff patterns, pesticide loads in dry weather runoff and storm runoff, and efficiencies of various management practices at a large commercial nursery located in Orange County, CA. Among the detected insecticides, bifenthrin was consistently found in the runoff. Fenpropathrin, cyhalothrin, cyfluthrin, and deltamethrin were sometimes found in the runoff. Runoff flow rates were continuously monitored by three flumes at one inlet and two outlets. The majority of runoff discharge was contributed by storm runoff which was about 10 times of the dry weather runoff volume. Mitigation practices including construction of retention basins and checkdams reduced about 34% of the total runoff volume and about 92% of bifenthrin loads under dry weather conditions. The checkdam at one outlet site reduced 15% of the storm runoff. This study shows that mitigation practices not only have reduced the volume of runoff leaving the nursery but also decreased the export of bifenthrin and other pesticides from the nursery.

175. Bioavailable metal concentrations from a heavy metal-rich fertilizer dose field study as measured by Diffusive Gradient Thin Films

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Fertilizers may contain variable concentrations of metals (and metalloids) including arsenic (As), cadmium (Cd), lead (Pb), mercury (Hg), and nickel (Ni). These metals may accumulate and pose a risk to soil and aquatic biota via off site transport and to human health through plant uptake. Bioavailable and total metal concentrations in four distinct agricultural soils amended with doses of heavy metal-rich fertilizer were measured from a randomized, replicated sampling-scheme over a four year period. Diffusive Gradient Thin Films (DGT) estimated labile metal concentrations in saturated soils. Site variation, estimated $K_{d\text{-}DGT}$, and metal concentrations in wheat and potato crops were also investigated. Preliminary results suggest Cd, Ni, and Hg may be enriched in potatoes while total soil Cd increased with treatment.

176. Phytoremediation of metals and salts while growing a better ethanol source crop

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Heavy metals and salts have accumulated in the soils of many agricultural areas in the United States and elsewhere as a result of the evaporation of irrigation waters and precipitation of metal salts or the use of herbicides containing arsenic. Arsenic, selenium, and boron are the metals of most concern; their presence and the presence of high chloride levels limits the utility of these areas for commercially sustainable crops. Such lands can be used for selected Malvaceae hybrids which have shown promise as an excellent source of hemacellulose and as a source crop for ethanol. These hybrids have also demonstrated efficacy in phytoremediation (bioremediation using plants) of metals and salts. This paper presents a summary of the research and compares the effectiveness of various plant species with Malvaceae hybrids. Initial research showed that Malvaceae species and hybrids were particularly effective at removing selenium and boron from soils and irrigation water in a chloride environment. The plants were also tested for their potential use as silage and as a source of complex sugars, dietary fiber, and protein for the food industry. Alternative cropping methods were evaluated. The attributes of these hybrids offer an opportunity to remediate agricultural lands while growing a commercially viable crop. Much of this work was supported by funding from the U.S. Department of Agriculture.

177. Development of improved methods of analysis for trace metals in fertilizer materials and blends

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Trace metal concentrations of fertilizers have been under scrutiny for years. Regulations are now in effect in many countries and several states. But, as is frequently the case, regulation preceded the methodology needed to properly enforce regulations and for industry comply. Now the methodology has caught up and a modern method of analysis for arsenic, cadmium, cobalt, chromium, lead, molybdenum, nickel, and selenium in fertilizers by microwave digestion and ICP-OES detection has been developed. The results of this study, the drivers behind it, as well as the process used to build a consensus method will be discussed. The outcome of this undertaking was not only a new method, but also development of a new reference fertilizer material through NIST. Additionally, a process for bringing together and focusing multidisciplinary stakeholders resulted in a method suitable to a broad range of materials, blends, and organic-based nutrients. All of these were measured over a wide range of analyte concentrations.

178. Perchlorate deposition in precipitation in the continental United States and selected northern hemisphere locations

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While most large scale perchlorate occurrences have been attributed to anthropogenic sources, in a number of cases, the sources have not been identified and natural sources have been proposed. For almost a century, perchlorate has been known to exist in Chilean nitrate deposits that are 16 million years old, and recent isotopic evidence has confirmed its source to be predominantly atmospheric. However, there is almost no data available concerning the deposition rate of perchlorate from precipitation. This research effort was designed to investigate the range of concentrations and the geographical variations in perchlorate deposition. Sub-samples of precipitation collected through the National Atmospheric Deposition Program were analyzed for perchlorate. Sample locations included 14 continental states, Hawaii, and Puerto Rico. In addition, these samples have been supplemented by intensive event sampling at one location (Lubbock, TX), as well as other scattered samples (e.g., Greenland). Perchlorate has been detected in a portion of samples from the majority of locations tested. Concentrations were generally low and quite variable and ranged from ND to 250 ng/L. Data to be presented will include results from 1 year of sample collection as well as analysis of general trends. Results from this study will have important implications to the national perchlorate issue and may aid in explaining the occurrence of non-anthropogenic perchlorate being reported in arid and semi-arid areas.

179. Natural occurrence of perchlorate in groundwater: Implications for dietary exposure

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Recently, the natural occurrence of perchlorate has become a subject of keen interest, as it has been detected in an increasing number of foods and beverages. We are conducting a synoptic survey of some 300 “pristine” groundwaters in the coterminous U.S. Unlike prior surveys of public drinking water supplies, our samples are evenly distributed geographically rather than spatially concentrated in proportion to population density. Using ion chromatography coupled with mass spectrometry, we can achieve a detection limit of ~40 ng/L perchlorate. About 60% of our samples contain detectable perchlorate, but only ~6% contain more than 1000 ng/L. Thus, a “typical” groundwater in the U.S. would contain 100 to 200 ng/L perchlorate. The data exhibit regional trends that suggest that natural occurrence of perchlorate is more prevalent in, but not confined to, semi-arid regions such as the desert southwest and intermountain west. The implications of these findings will be discussed with an emphasis on irrigated crop production.

180. **Analytical methods for the determination of perchlorate anion in foods**

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Perchlorate anion, a rocket fuel component as well as occurring naturally, has been found in many water systems in the U.S. and can bioconcentrate in growing plants used as food. Because perchlorate competitively inhibits iodide uptake by the thyroid, its presence in the food supply is a public health concern. In order to assess the risks from dietary exposure to perchlorate, FDA developed a rapid, sensitive, and specific analytical method. Since 2004, over 1500 food samples were analyzed for perchlorate presence by ion chromatography (IC) with isotope dilution tandem mass spectrometry (MS) capable of 1 µg/kg limit of quantitation. Commodities consisted primarily of leafy vegetables as well as select fruits collected from growers nationwide with emphasis on fields in the Southwest irrigated by perchlorate-contaminated Colorado River water. Some imported crops were included in the survey. Bovine milk and feed were sampled at dairy farms. The IC-MS/MS method will be described, and perchlorate findings will be discussed in the presentation. Comparative results will be shown obtained by a column-switching IC method with suppressed conductivity detection offered as a cheaper alternative for limited purposes.

181. **California best management practices (BMP) for perchlorate materials**

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In December 2005, the California Department of Toxic Substances Control (DTSC) adopted emergency regulations for Best Management Practices of perchlorate and all perchlorate-containing substances with a primary purpose of protecting water resources (California Health and Safety Code, Section 25210.6 and California Code of Regulations, Title 22, section 67384). This regulation implements the legislative mandate of the Perchlorate Contamination Prevention Act (Assembly Bill No. 826). The Act identifies fertilizers as a “perchlorate material” and consequently, persons managing fertilizers are subject to compliance with the BMP unless specifically exempted. The BMP's provisions pertaining to fertilizers include requirements for labeling, packaging, containment, notification, and pollution prevention. The impact and implications of this bill to the fertilizer and agricultural community will be discussed.

182. **Volatile organic compound emissions from pesticides**

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Many active as well as inert ingredients in pesticide products are volatile organic compounds (VOCs) and contribute to the formation of ozone in the troposphere. As required under California's State Implementation Plan for the federal Clean Air Act, the Department of Pesticide Regulation (DPR) tracks and reduces VOC emissions from pesticides in certain ozone nonattainment areas. DPR estimates pesticide VOC emissions based on the VOC content for individual pesticide products and the amount of those products used. Fumigants and pesticides formulated as emulsifiable concentrates make up the majority of the pesticide VOC emissions in all nonattainment areas. The San Joaquin Valley is likely the most problematic area for pesticidal VOCs, and DPR currently does not meet its VOC reduction commitment for this nonattainment area. DPR has initiated regulatory actions to increase the accuracy of its VOC emission estimates and reduce VOC emissions from pesticides.

183. **Near-field air quality impacts from fumigant applications**

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Following applications, soil-applied fumigants generally escape the field and are released into the air resulting in exposures to bystanders. The air quality risk associated with fumigants can be divided into (1) near-field and (2) far-field effects. The near-field effects relate to high exposures to the small populations living in close proximity to the field, whereas the far-field effects refer to the general background concentrations caused by multiple applications in an area. For near-field effects, a dispersion modeling system called the Probabilistic Exposure and Risk model for FUMigants (PERFUM) can be used to assess exposures and risks. PERFUM adapts EPA air dispersion algorithms to develop probabilistic estimates of acute exposures to bystanders following fumigant applications for fields of up to 40 acres. The model can be used to estimate the concentrations surrounding a field in terms of direction and downwind distance. Thus, the model can be used to estimate the probability of exceeding an exposure standard in terms of the location of a bystander relative to the field. This presentation will include modeling results for several fumigants using PERFUM and a discussion of what the model results tell us about air quality impacts from fumigants.

184. **Micrometeorological effects on metolachlor volatilization: An 8-year case study**

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Pesticide volatilization is a significant loss pathway that may have unintended consequences to non-target environments. Metolachlor volatilization (a pre-emergent herbicide) was monitored over an eight-year period. A micrometeorological flux gradient technique was used to compute volatilization fluxes from concentration profiles and turbulent fluxes of heat and water vapor (as determined from eddy covariance measurements). Differences among years of micrometeorological and surface soil water conditions resulted in variability of volatilization losses among years. Peak volatilization losses for each year occurred during the first 24 hours after application with maximum flux rates associated with wet surface soil conditions and warm temperatures. Cumulative volatilization losses for the 120-hour period following application varied across years from 5 to 25% of applied active ingredient. Across all years, volatilization occurred diurnally and accounted for between 43 to 86% during the day and 14 to 57% during the night of the total measured loss.

185. Characterization of ammonia and hydrogen sulfide emissions from a swine farm in North Carolina

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NH_3-N and H_2S emissions from a commercial anaerobic swine waste treatment lagoon (30,630 m^2) and a fan-ventilated swine confinement building next to the lagoon were measured for ca. 1 week using a dynamic flow-through chamber system during Oct-Nov 2004 (fall), Feb (winter), Apr (spring), and Jun 2005 (summer). Samples were collected daily and analyzed for Total Kjeldahl Nitrogen (TKN), Total Ammoniacal Nitrogen (TAN), and total sulfide concentration (mg/L) to examine diurnal and seasonal variability and relationships to surface temperature and pH of the lagoon. TKN, TAN, and sulfide concentrations ranged from 400 - 650, 360 - 590, and 0.1 - 13.0 mg/L, respectively. The largest NH_3-N fluxes were in summer (~4.2 mg N m^{-2} min^{-1}). During fall and spring, fluxes were 1.6 ± 0.5 and 2.5 ± 0.5 mg N m^{-2} min^{-1}, respectively, and in winter: 1.3 ± 0.2 mg N m^{-2} min^{-1}. H_2S fluxes were lowest during winter (~0.0 µg m^{-2} min^{-1}), increased during fall (0.3 ± 0.1 µg m^{-2} min^{-1}) and spring, (0.5 ± 1.0 µg m^{-2} min^{-1}), and were highest in summer (5.3 ± 3.2 µg m^{-2} min^{-1}). Generally, lagoon emissions for H_2S were ca. 3 - 4 orders of magnitude less than NH_3-N. NH_3-N and H_2S emissions from the swine confinement house were made for ~1 week prior to or following the lagoon experiments. Static pressure inside building, fan flow rates, and barn temperature at the outlets were measured continuously. NH_3-N emissions were highest in spring (50 ± 20 mg N min^{-1} 1000kg live animal weight^{-1} (LAW)) and were lowest during summer (19 ± 12 mg N min^{-1} 1000kg LAW^{-1}). H_2S emissions were lowest in summer (2.5 ± 1.5 mg min^{-1} 1000kg LAW^{-1}) but observed to be highest during winter (7.1 ± 2.8 mg min^{-1} 1000kg LAW^{-1}). During summer, the house was cleaned 3 weeks prior to the experiment.

186. Agricultural ammonia emissions, uncertainty, and applications to air quality modeling

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Agricultural ammonia emissions contribute to inorganic particulate matter, nutrient loading, and acidifying deposition to sensitive ecosystems. However, a complete understanding of these processes has been substantially limited by uncertainties in the ammonia emission inventory. In this talk, we present a novel approach to ammonia emission modeling, where a process-based mechanistic emissions model is coupled with Bayesian parameter estimation techniques to simulate more accurately local farming conditions. Using a database of farming practices, we develop an agricultural ammonia emission inventory for the United States. We then apply a variety of sensitivity analysis techniques to this emission inventory to understand better the sources of uncertainty in agricultural ammonia emissions. Using this emission inventory in a chemical-transport model simulation for the eastern US, we find that accurately representing the seasonal and diurnal variation in ammonia emissions is critical to accurate predictions of ammonium nitrate particulate matter.

187. Effects of microbial additives on odor quality of swine slurry

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Beginning in February 2005, new legislation on odors from swine feeding operations was enforced in Korea and various efforts have been made to reduce the odors. Among them, application of microbial additives to swine slurry is widely used due to their low cost and ease in application. The objective of this study is to evaluate the effectiveness of commercially available microbial additives in reducing odor emissions from storage tanks for swine manure. Four different microbial additives (A, B, C, and D) were purchased; two (A and B) are for aerobic systems and the others are for anaerobic systems. For comparison, no treatment was also made. Once swine slurry (60 L) was put in a container (80 L), the slurry was treated appropriately with the additives; the slurries with additives A and B were agitated to create an aerobic condition while the ones with C and D were not. From day 0, slurry aliquots were collected frequently from the containers and were analyzed for TS, TVS, BOD5, TKN, NH_4^+-N, TP, CODCR, and *E. coli* counting for 3 months. A total of 17 different odorants emitted from the surface of the slurry were quantified using solid phase microextraction coupled with GC/MS. Analytes included indole, skatole and *p*-cresol, trimethylamine, ammonia, organics acids (i.e., acetic, propionic, isobutyric, butyric, isovaleric, and valeric), mercaptanes (i.e., ethyl, propyl, and butyl), dimethyl sulfide, dimethyl disulfide, and carbon disulfide. After 90 days of operation, the slurry with additives A and B and agitation produced more than 70% less odorants than the control, while the slurries with C and D did not show any improvement in odor quality. In addition, the number of *E. coli* in the slurry treated with A and B decreased rapidly, indicating faster manure stabilization would be possible.

188. Role of herbicide metabolism in weed resistance to herbicides

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Metabolic detoxification is the major mechanism in crop plants for conferring herbicide selectivity, but it can also confer resistance to herbicides in weeds. The two major enzyme systems involved in herbicide metabolism in plants are the glutathione S-transferases (GSTs) and cytochrome P-450s, although other enzymes such as tonoplast ABC transporters and glucosyl transferases may also be involved in the overall cellular detoxification pathway. GSTs catalyze the conjugation of reduced glutathione to herbicide substrates, leading to their irreversible detoxification and transport into the vacuole. P-450s are also important metabolic enzymes that typically catalyze ring-hydroxylation reactions, although these enzymes also perform alkyl hydroxylation and N-dealkylation reactions with herbicide substrates. Biotypes of several weed species, including *Abutilon theophrasti*, *Alopecurus myosuroides*, *Amaranthus tuberculatus*, and *Lolium spp.* have evolved non-target site mechanisms for herbicide resistance, including enhanced metabolic detoxification via GSTs and P-450s. One potential advantage of this mechanism relative to altered target sites is the lack of a fitness penalty, although little research has been conducted to directly compare ecological fitness consequences between target site versus non-target site mechanisms in resistant biotypes in the same weed species.

189. Characterization of an exclusion mechanism for glyphosate resistant weeds

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Since the introduction of glyphosate, eight species have been reported as glyphosate resistant worldwide. Three have been reported in the context of Roundup Ready® crops: *Conyza canadensis* (2000), *Ambrosia artemisiifolia* (2004), and *Amaranthus palmeri* (2005). EPSPS variants are only reported for *Lolium multiflorum* and *Eluesine indica*, but the point mutations identified provide a very low level of resistance. Resistance is not due to the metabolism of glyphosate in any of the species. A third resistance mechanism is exclusion, which includes both active and passive methods for preventing a pesticide from interacting with the target enzyme. The lower shikimate:glyphosate ratio in the resistant biotypes indicates a mechanism that functions to shield the EPSPS target enzyme from glyphosate. Data supporting the exclusion mechanism for glyphosate shows that uptake is similar between sensitive and resistant biotypes and has reduced glyphosate translocation in the resistant biotypes of horseweed, ryegrass, and ragweed.

190. New insights into auxin herbicide resistance

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Synthetic auxin herbicides such as 2,4-D have been used for weed control for over sixty years. However, the occurrence of field resistance to auxinic herbicides has been relatively rare and has not seriously interfered with the continued use and introduction of compounds with this mode of action. The low incidence of resistance and the difficulty in characterizing auxin resistance mechanisms in weeds have been attributed to the complexity and pleiotropic nature of the auxin response. In contrast, lab studies using Arabidopsis have uncovered a wide variety of 2,4-D-resistant mutants that have led to recent gains in understanding of the molecular mechanisms of auxins. We have exploited the chemical diversity of synthetic auxin herbicides to further explore auxin resistance in Arabidopsis and to reveal interesting chemical selectivities within the auxin response pathway. The relevance of these studies to the performance of and field resistance to synthetic auxins will be discussed.

191. Ecology and evolution of herbicide resistant weeds

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Herbicide resistance is the inherited ability of a plant to survive and reproduce following exposure to a dose of herbicide that is normally lethal to the wild type. Factors that influence the rate of resistance evolution include initial frequency of the trait, herbicide selection pressure, and properties of the weed, such as seed longevity. In some cases, reduced fitness of resistance phenotypes retard the evolution of resistance and allow reversion to susceptible phenotypes in the absence of the selecting herbicide; however, in many cases, fitness of resistant and susceptible phenotypes is similar. Resistance typically occurs because of repeated use of the same herbicide or mode of action over several years. Resistance management requires reducing herbicide selection pressure with alternative methods including mixtures or sequences of herbicides with different modes of action, crop rotations that alter management practices, non-chemical cultural practices, certified seed and clean equipment, and integrated weed management.

192. Challenges to modeling the selection and spread of glyphosate-resistant weeds

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Since first reported in an Australian *Lolium* population in 1996, resistance to glyphosate among weeds in various world areas has become an emerging threat to agricultural systems. Most of the resistant biotypes have only slightly enhanced glyphosate tolerance and are easily controlled through minor and inexpensive adjustments to the overall weed management strategy. However, recent reports of isolated, but quite resistant *Amaranthus* populations are potentially more troublesome. Earlier this year, in response to the current technical challenge posed by the resistance issue, Monsanto formed the cross-functional Weed Assessment and Resistance team, whose objective is to develop and implement sustainable weed control practices that limit the spread of existing resistant biotypes and avoid selecting new ones. Modeling is a potentially useful tool in helping to evaluate such practices, but its application to the phenomenon of glyphosate weed resistance has many unique and daunting challenges that will be explored in this presentation.

193. Atmospheric deposition of nitrogen in precipitation across the United States

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The National Atmospheric Deposition Program's National Trends Network (NTN) has measured the acids, nutrients, and base cations in U.S. precipitation since 1978. The NTN has over 250 precipitation-monitoring stations throughout the continental US, the Virgin Islands, Puerto Rico, and Alaska. Precipitation scavenges airborne gases and particles, which are affected by emissions, chemical transformations, and weather. NTN data indicate that ammonium concentrations have increased in precipitation over the last 20 years at the majority of NTN stations with the largest ammonium increases in the Midwestern states. This presentation will discuss the NTN program and the trends observed for nitrogen and ammonium levels in precipitation.

194. Nutrient movement below cattle feedlot operations in Kansas

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Kansas is the third largest cattle state in the nation. At operational, open-air, cattle feedlots, high levels of nitrogen and phosphorous are continuously deposited on the soil surface. The fate of these nutrients in manure is of environmental concern especially for air and ground water quality. This paper will focus on the physical conditions of the pen surface and the chemical characteristics of soil profiles sampled from several feedlot operations across a precipitation gradient in Kansas. Soil samples were analyzed for extractable ammonium, nitrate, phosphorous, and chloride; total carbon and nitrogen; and pH. Each location has different soil physical characteristics: texture and structure. Analysis has shown that there is nitrogen movement up to 2 m below the pen surface at three different sampling sites. At most sites, nitrogen was predominantly in the ammonium and organic forms, while one location shows evidence of nitrification.

195. Assessing the water quality significance of nitrogen and phosphorus compounds concentrations in agricultural runoff

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Excessive growth of aquatic plants causes significant water quality/beneficial-use problems, including low dissolved oxygen, water quality impairment of domestic water supplies, impairment of recreation, etc. The growth of aquatic plants to excessive levels is driven by nitrogen and phosphorus compounds from a variety of sources, including agricultural stormwater runoff, tail water, and subsurface drain water discharges. Because of the significance of those sources, many water quality monitoring programs include the suite of nitrogen and phosphorus compounds that serve as aquatic plant nutrients. To this end, statements such as “Water shall not contain biostimulatory substances which promote aquatic growths in concentrations that cause nuisance or adversely affect beneficial uses" are appearing in some regulations. However, guidance is not provided on how to evaluate “excessive” biostimulatory substances. The nutrients, themselves, are not problematic; they are only of concern as they become manifested in excessive amounts of aquatic plant material, some of which is essential for maintaining a healthy ecosystem. This paper discusses the issues that need to be considered in determining excessive concentrations of nutrients in agricultural runoff.

196. Is agriculture ready for enhanced efficiency fertilizer products?

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Enhanced-efficiency fertilizers have been used for many years in specialized crops and applications to help increase crop productivity and nutrient-use efficiency. Their effectiveness in reducing nutrient losses and increasing nutrient-use efficiency has been well documented, but their use has largely been limited by high cost. In recent years, higher fertilizer prices and greater concern over nutrient impacts on the environment have stimulated interest in adopting these products for widespread agricultural use. New products targeted at commodity crops are on the market or under development. How will agriculture adapt to these products over traditional nutrient-management practices? What supply chain changes will be necessary for their use? How well do they fit in traditional crop production? Can enhanced-efficiency fertilizers perform sufficiently better than conventional fertilizers to justify the higher nutrient cost? Do enhanced-efficiency fertilizers qualify for the same government programs as conventional Best Management Practices? Many questions are being raised as interest in enhanced-efficiency fertilizers grows. This paper will discuss some of the issues surrounding the adoption of enhanced-efficiency fertilizer by mainstream agriculture.

197. Development of methods for measuring timed release nutrients in the lab and in soil

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As environmental and economic pressures drive agricultural efficiency to new levels, nutrient delivery technologies must respond. As new and different types of technologies and practices are developed, a better means of assessment and regulation will be needed. Consequently, improved methods to characterize nutrient release and availability must also be developed. Past and current analytical methods focused on measuring what was not released; consequently, results could not be related to nutrient availability over time. Efforts to develop two methods that provide more information are underway, being fine-tuned and correlated. A laboratory method measuring accelerated nutrient release in less than a week is undergoing collaboration through AOAC. At the same time, an ambient soil method has been developed that uses a biologically active soil system to assess nutrient release. Results of both methods will be presented including assessment data for current and emerging technologies designed to enhance agricultural efficiency and minimize excess nutrient release to the environment.

198. Advances in the simultaneous determination of nitrogen and other key elemental constituents of fertilizers using inductively coupled plasma emission spectroscopy

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Fertilizers are custom formulated for specific soil types and crops. Often, these fertilizers contain a significant percentage of nitrogen compounds to supplement the soil nutrients. Accurate control of nitrogen content in fertilizers helps to minimize material costs and improve fertilizer efficiency. While ICP-OES is frequently used to determine elemental concentrations in fertilizers today, few people attempt to quantify nitrogen by this technique. Nitrogen is present in fertilizers at high enough concentrations to be accurately measured by ICP-OES but reporting errors arise from gaseous nitrogen dissolved in the samples and nitrogen introduced from entrained air. If air can be removed from samples and the plasma introduction system, then nitrogen can be determined at the same time, other major constituents and trace contaminants are measured. This presentation will describe the design and performance of a new ICP-OES designed to facilitate simultaneous nitrogen, phosphorus, potassium, sulfur and metal determinations in phosphorus based fertilizers. The spectrometer is a high resolution Echelle based ICP that utilizes a Large Format Programmable Array Detection System (L-PAD) and is equipped with a modified sample introduction system that removes dissolved nitrogen. This instrument provides the sample throughput and accuracy necessary to meet these changing analyses.

199. Measuring and improving physical properties of fertilizer materials and blends

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Granular fertilizers will interact with their environment and can either loose moisture or gain moisture depending on the prevailing atmospheric conditions. This property has important implications to maintaining free flowing material during the transportation and storage of bulk fertilizers. The movement of water drives crystal formation and crystal bridging between granules which is a major cause of caking or lump formation. Critical relative humidity is defined as the percent humidity at a given temperature when a fertilizer begins to absorb moisture. Critical relative humidities were measured for a number of granular fertilizers, and the data collected were compared to information available in the literature. Accelerated caking tests using controlled temperature and humidity conditions were also run on the same set of granular fertilizers. The critical relative humidity information was used to determine the conditions of the caking tests. The critical relative humidity and the caking data were then compared.

200. Harmonizing methods of analysis for international shipments of fertilizer materials

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As fertilizer materials become more commonly traded and shipped around the world, analytical methodology, regulatory language, and terms need to be harmonized in order to facilitate trade among companies and trading nations. A worldwide look at the methods used for these transactions will be discussed and presented. The methods to be reviewed include physical, nutrient, and non-nutritive parameters. A number of organizations and regulatory bodies develop, certify, approve, or otherwise impact method use and acceptance around the world. While many of these methods have their roots in the same chemistry and detection techniques, there is enough variation across these methods to dramatically affect agreement and reproducibility. These variations are often the source of contractual and economic disagreements that impact trading companies. The focus of this presentation is an effort being led by IFA (the International Fertilizer Association) to begin the evaluation process of all available methods used in fertilizer commerce around the world. After this evaluation is complete, the highest performing methods that can be accurate, precise, and reproducible across many laboratories will be identified, and hopefully will used in future transactions.

201. Finding stinky "needles" in the chemical "haystack" of livestock odor: Efforts towards solving livestock odor problems with SPME and multidimensional GC-MS-O

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Air sampling and characterization of odorous livestock gases is one of the most challenging analytical tasks. This is due to low concentrations, physicochemical properties, and problems with sample recoveries for typical odorants. Livestock operations emit a very complex mixture of volatile organic compounds and other gases. Many of these gases are odorous. Relatively little is known about the link between characteristic odors and VOCs and specifically, about the impact of specific odorants downwind from sources. In this research, solid phase microextraction (SPME) was used for field air sampling of odors downwind from swine and beef cattle operations. Sampling time ranged from 20 min to 1 hr. Samples were analyzed using a commercial GC-MS-Olfactometry system. Odor profiling efforts were directed at odorant prioritization with respect to distance from the source. The results indicated the odor downwind was increasingly defined by a smaller number of high priority odorants. These ‘character defining' odorants appeared to be dominated by compounds of relatively low volatility, high molecular weight and high polarity. In particular, *p*-cresol alone appeared to carry much of the overall odor impact for swine and beef cattle operations. Of particular interest was the character-defining odor impact of *p*-cresol as far as 16 km downwind of the nearest beef cattle feedlot. The findings are very relevant to scientists and engineers working on improved air sampling and analysis protocols and on improved technologies for odor abatement. More research evaluating the use of *p*-cresol and a few other key odorants as a surrogate for the overall odor dispersion modeling is warranted.

202. Inverse modeling: A tool for evaluation of ammonia emission inventories

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Characterizing ammonia emissions from the predominant agricultural sources is challenging because the emissions are dispersed and influenced by varying farming practices and meteorological factors. It has been demonstrated that inverse modeling can be a useful tool for evaluating regional scale ammonia emissions inventories and estimating seasonal variability in the emissions. Using inverse modeling as an evaluation tool with emission inventories has demonstrated how bottom-up and top-down approaches can be used in a complimentary and powerful combination. With the reduced uncertainty in the more recent ammonia inventories, we have concluded that the current inverse modeling approach has met some quantitative limits because of competitions between model and emission inventory uncertainty. While we continue to investigate qualitatively seasonal and interannual variations in ammonia emissions, we strongly advocate for a standardized network of NHx data for more quantitative evaluation of NH3 emission inventories.

203. Simulating the atmospheric concentration and deposition of ammonia on a small scale

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The project VELD was carried out during a 14 month period in an 9 km^2 agricultural area with a high density livestock. A major goal was to see to what extent temporal and spatial variations of ammonia concentrations could be explained by local agricultural activities. Information on activities was collected and translated to emissions with a high temporal and spatial resolution. Meteorological parameters and ammonia concentrations were measured continuously. Simulations of atmospheric concentrations were carried out by the OPS model. The comparison of modeled and measured concentrations revealed a good correlation, especially during winter time: 60% of daily variations could be explained. Concentrations were highest during periods of extensive manure application. In these periods, the model underestimated the ammonia levels significantly. Emission factors that are too low or variations in dry deposition or both may explain the discrepancy. Spatial differences could be explained very well: more than 75% of the variations in an area of 3x3 km^2 for annual mean concentrations.

204. Modeling dry deposition of atmospheric pesticides to an agricultural watershed in Washington

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Dry deposition is one route by which pesticides that enter the atmosphere during and after application are returned to the terrestrial environment. Two dry deposition models previously reported in the literature, one for particle-phase and one for vapor-phase, were modified so they could be used for pesticides in the terrestrial environment. These models were applied to measured air concentrations (particulate and vapor samples) to determine the flux of eleven pesticides to a small agricultural watershed in Washington. Both models incorporated time-dependant changes in weather and vegetation growth, as well as spatially-variable land use. The annual fluxes of the pesticides to the watershed were estimated based on simulations at an hourly time-step. The vapor-phase model also included compound-specific Henry's law constants. The particle-settling velocity calculations were most sensitive to particle diameter and wind speed, whereas the vapor-settling velocity was most sensitive to the Henry's law constant. Vapor-phase settling was calculated to be the dominate dry depositional mechanism for pesticides that have a vapor pressure greater that 10^{-5} Pa.

205. Pesticides in Canadian prairie air: The ups and downs

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The majority of Canadian agricultural pesticide applications occur on the prairies. This region is predominantly one of grain and oilseed cultivation and most of the pesticides applied are herbicides. Some of these herbicides are sufficiently volatile to appear frequently in prairie air in vapour phase. Other, less volatile herbicides, adsorbed to soil particles, can become airborne through wind erosion. Pesticides in the air can be deposited in rainfall but can also be dry-deposited. This paper will present information on the atmospheric concentrations of currently-used herbicides and rates of dry and wet deposition to prairie wetlands.

206. Past and currently used pesticides in the air and precipitation in Québec, Canada

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Air samples were collected and analyzed for 91 pesticides or metabolites between May to September 2004 in St. Damase, an agricultural site located in Québec, Canada. A broad range of pesticides were detected during this experiment where 40 different compounds were measured. Most of the samples presented more than 10 simultaneous pesticide detections and sometimes reaching 19 simultaneous detections. The most detected pesticides were trifluralin, metholachlor, and captan, which were found in all the samples during the five months measurement. For the detected compounds, the average detected concentrations ranged from a few pg/m^3 to several ng/m^3. The more important detected pesticides were related with corn & soya cultivations, the two most important culture in this region. The partitioning of these pesticides between particle and gas phases was investigated and compared with the Junge/Pankow and K_{oa} models. Some pesticides presented good agreement with the models whereas other pesticides did not. Others factors which could influence the partitioning of pesticides as temperature, TSP concentrations and relative humidity were tested for atrazine. It was found that the temperature and TSP concentrations are important parameters for the gas/particle partition whereas relative humidity variations did not seem to modify the atrazine partition. In addition, the results from several lindane flux experiments done after corn seeding will be related to environmental factors.

207. Technologies to reduce pollution of the air with pesticides

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Pesticides can find their way into the air in many ways. One that is most frequent is drift of pesticide particles away from the application site during and/or after the application of pesticides. Some recent studies indicate that once mixed in the air, pesticides can move hundreds, and sometimes thousands of miles before depositing on the surface. For example, some pesticides that were used only in southern United States, and later banned in late 70's were found in the 90's at the arctic circle. Drift is influenced by many factors. They usually fall into one of the following four categories: (1) Spray characteristics; (2) Equipment/application techniques; (3) Weather; (4) Operator skill and care. This paper discusses equipment and technologies recently discovered that have the highest potential to reduce spray drift and pollution of air with pesticides.

208. Use of liquid suspension array technology to measure environmental, bioterrorism and immunodiagnostic analytes

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Luminex® multianalyte liquid suspension array profiling (Xmap®) technology can be used to develop fluorescent covalent microsphere immunoassays (FCMIAs) for numerous types of analytes using indirect, competitive, capture/sandwich as well as other assay formats. We have described FCMIAs for serologic markers to 5 CDC select agents (*Bacillus anthracis,Yersinia pestis, Francisella tularensis*, ricin toxin, and staphylococcal enterotoxin B; *Analytical and Bioanalytical Chemistry* 382:1027-34, 2005), IgG antibodies to anthrax toxins (*Clin Diag Lab Immunol* 11:50-55, 2004), IgG antibodies to 23 pneumococcal polysacchrides (*Clin Diag Lab Immunol*, 10:744-750, 2003), 3 pesticides/metabolites (*Analytical and Bioanalytical Chemistry*, 379:368-374, 2004), genetically-modified-organism pesticidal proteins (Cry1Ab and Cry3B) and 25 cytokines (IL-1β, IL-1ra, IL-2, IL-2R, IL-4, IL-5, IL-6, IL-7, IL-8, IL-10, IL-12p40, IL-13, IL-15, IL-17, TNF-α, IFN- α, IFN-γ, GM-CSF, MIP-1- α, MIP-1-β, IP-10, MIG, Eotaxin, RANTES, and MCP-1). In general, FCMIAs are faster, more sensitive, use less sample, are more precise, and have higher throughput than any competing assay technology. In this presentation, we describe the performance of these analyses and their usefulness as diagnostic and environmental methods, comparing them to traditional enzyme-linked, immunosorbant assays (ELISAs) and classical instrumental methods, such as gas- and high performance liquid chromatography. The findings and conclusions in this abstract have not been formally disseminated by the National Institute for Occupational Safety and Health and should not be construed to represent any agency determination or policy.

209. New microarray developments: On-chip microfluidics and electrasense detection technology

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Microarray-based bioassays have become a key, enabling technology in molecular biology with broad applicability in a variety of settings, including infectious disease surveillance, clinical diagnostics, environmental toxicology, and homeland security. Microarrays may contain DNA, oligonucleotides, proteins, peptides, carbohydrates, or organic compounds. Traditionally, they are manufactured using “spotting techniques”. CombiMatrix has developed 12,000 feature semiconductor microarrays, which have the potential to detect hundreds of different viruses and bacteria simultaneously. These microarrays are manufactured using *in situ* synthesis of over 12,000 unique DNA sequences. In addition, we have developed a unique electrochemical detection (ECD) based ElectraSense$^{\text{TM}}$ microarray platform, which eliminates the need for an expensive optical system and fluorescent reagents. We have also investigated different approaches for integrating microfluidics and automated sample processing. DNA-based microarray assays involve multi-stage sample processing and fluidic handling which are generally labor-intensive and time-consuming. Using microfluidic technology to integrate and to automate all these steps in a single device is highly desirable.

210. Multiplex immunochemical detection of food contaminants and adulterants

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In monitoring programs in which different compounds need to be tested, the general comment about immunoassays is that they are too specific. For each compound, a different immunoassay has to be performed and, where multiple drug residue detection is necessary, a shift is shown towards multi-residue LC-MS screening methods. To overcome the disadvantage of specificity, different approaches for multiplex detection were investigated, such as the application of group-specific antibodies (with sulfonamides as model compounds) and multi-channel biosensor assays (four flow channel Biacore for proteins and aminoglycosides). However, this has resulted in limited multiplex assays only, with a maximum of four different (groups of) compounds. A relatively new system for ultiplex detection is based on the Luminex xMAP$^{\text{TM}}$ technology (Luminex Corporation, Texas, USA). In theory, this flow cytometry-based system allows the simultaneous measurement of up to 100 different residues in one well using antibody- or antigen-coated microspheres labeled with 100 different distinguishable fluorophores. Results will be shown with respect to the development of multiplex assays for the detection of plant proteins (soy, pea, and soluble wheat proteins) in milk powder and residues of allergenic proteins and veterinary drugs in food.

211. **Microbead immunoassays for detecting biological agents in finished water**

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The rapid detection of biological agents in finished water is important for monitoring our drinking water supply for natural and purposeful contamination with harmful agents. Microbead immunoassays were developed for detecting viruses, bacteria, spores, and toxins in water using the following simulants: MS2 bacteriophage virus, *B. globigii* spore, *B. anthracis* Sterne strain gamma-irradiated spore, *E. coli* O157:H7 heat-killed bacterium, and ovalbumin toxin. The paramagnetic microbeads to which the captured antibody was attached function as a mobile solid phase on which the immunoassay was performed. The assays were tested for possible interference by conditions that are commonly found in finished water: basic pH, hardness, organic material, soluble iron, fluoride, phosphate, and disinfectants. Assays for some agents showed sensitivity to chlorine and monochloramine. When tested on 20 water samples collected from various water supplies throughout the U.S., the immunoassays were able to detect each of the five simulants spiked into these water samples.

212. **Kinetic exclusion immunosensors for low molecular weight environmental contaminants**

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Two immunosensors that employed a “kinetic exclusion” method have been used to develop a variety of assays for low molecular weight contaminants. The prototype sensors and associated software were provided by Sapidyne Instruments, Inc. (Boise, ID). These sensors produced assays that were 100- to 1000-fold more sensitive than indirect competitive ELISAs prepared using identical primary antibodies and analyte-conjugates. Analysis of operator-prepared samples in the field-portable instrument required 165 seconds, and CV's were 10-15%. The in-line sensor had the ability to collect a sample from a process line, add reagents, inject the incubation mixture, and compare the results to an instrument-generated standard curve. Total analysis time, including washing and mixing, was between 600 and 900 seconds, and CV's were 5% or less. These sensors have been used to develop assays for heavy metals and caffeine in environmental and food samples. Supported by the US DOE (DE-FG02-98ER62704) and USGS (04HQA0141 and 05HQAG0109).

213. **Nanosensor for environmental monitoring and public safety**

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Molecular recognition and physical transduction are the two main components in sensing phenomena. Employing nanoscale materials as transducers and nanotechnology to develop nanoscale sensing devices will lead to new generation sensors as the particles with nanoscale dimensions display properties different from bulk materials. This presentation will discuss the development and application of indium tin oxide and carbon-nanotube-based sensors, as well as new sensor fabrication techniques for environmental monitoring, public safety, and homeland security.

214. **Functionalized porous silicon: Tunable platforms for bioanalytical sensor design**

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Potentially, nanofabrication methods will have a profound impact on the bioanalytical methods of the near future. Biorecognition events, which serve as the core to any screening method, are processes that take place on the nanoscopic level. Increased surface area, enhanced specificity and sensitivity, and practicality are but a few of the attractive features offered by nanoscale based devices. Porous silicon (por-Si), a unique nanocrystalline form of silicon, has demonstrated great potential for a variety of sensor and drug delivery applications. However, the native hydride-termination por-Si is easily oxidized. Using established thermal, microwave, Lewis-acid catalyzed, and carbocation-mediated hydrosilylation methods, we have functionalized por-Si surfaces which avoid degradative oxidation by forming direct silicon-carbon bonds. Semiquantitative FTIR spectroscopy indicates that the functionalization of the por-Si surface provides greatly-improved stability for an extended period of time in simulated acellular plasma (blood). In each of the reactions presented, the stability of the functionalized por-Si surface was greatly improved, yet variation due to reaction method was observed. These functionalized porous silicon substrates deteriorated at a reduced rate in simulated biological environments making them attractive candidates for the development of highly sensitive, yet inexpensive sensing platforms.

215. **Nanotechnology for immunochemistry and detection of infectious agents**

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A typical immunoassay uses a target recognition antibody functionalized with a reporter such as a fluorescent dye. However, traditional organic dye molecules suffer from photobleaching, resulting in poor sensitivity and poor antigen quantification capability especially in dilute samples. Over the past decade, semiconductor quantum dots (QDs) have become popular as biological labels due to their small size, narrow emission, superior brightness, higher photostability, and suitability for immunochemistry. These properties render QDs nearly ideal for highly sensitive, quantitative, and multiplexed immunoassays in complex samples obtained from patients or the environment. This presentation describes a dual-modality immunoassay employing QDs for target identification and multiplexed detection with magnetic nanoparticles and microparticles for target enrichment in heterogeneous dilute samples. Using magneto-optical immunoassay and optically-coded nanoparticle probes, detection of cancer biomarkers and infectious agents, such as respiratory syncytial virus, in a high-throughput, automated imaging based format will be demonstrated. Combination of novel nanoparticle probes, dual modality immunoassay design, and high-throughput imaging is likely to open avenues for ultrasensitive and quantitative immunoassays.

216. Organophosphorus hydrolase multilayer modified microcantilevers for organophosphorus detection

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We report a biosensor based on organophosphorus hydrolase (OPH) multilayer modified microcantilever (MCL) for detection of organophosphorus compounds (OPs). The OPH functionalized MCL underwent bending when it was exposed to paraoxon, parathion, and diisopropyl fluorophophate in solutions. The magnitude of the bending was proportional to the concentrations of OPs. The cantilever bending was more sensitive to paraoxon than other OP compounds. The conformational change of the OPH might be the main origin for MCL bending.

217. Immunochemical analysis of agrochemicals: Trends and perspectives

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Although antibodies have been used for several decades for the immunochemical analysis of agrochemicals, there is yet considerable potential for this technology. However, future progress is still limited by the availability of customized antibodies. Up to now, about 35 different recombinant antibodies have been raised against agrochemicals. Only recently antibody libraries were successfully employed to express antibody genes from larger antibody repertoires. Fundamental antibody properties can be improved by evolutionary design, for instance, affinity patterns, thermal stability, and robustness against matrix effects. The success of current antibody-based binding assays has triggered the search for antibody substitutes. Besides synthetic peptides, aptamers, and molecular imprints (MIPS), receptor assays for effects monitoring are considered. Comparable to array technologies in immunochemistry, this concept has recently been extended to environmental analysis by transcriptome analysis, which allows the measurement of multiple effects of pollutants at the level of gene expression, giving precise insights into their effects.

218. Recent advances in sol-gel immunochemistry: Application for agrochemical monitoring

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Increasingly, immunoassays are being applied for monitoring agrochemicals in food and environmental samples. The rapidity, sensitivity, simplicity, and cost-effectiveness of the methods have made them an attractive tool, and they have been optimized for monitoring of a wide variety of compounds. Despite the major advantages introduced by immunoassays, the varied and complex matrixes that serve as sources for analyte monitoring, the low concentrations of the analytes within the matrix, and the presence of compounds that interfere with the analytical method introduce barriers that limit their wider application for agrochemical analysis. Recently, a novel technology, based on entrapment of biomolecules in a ceramic matrix, which overcomes many of the above limitations, has been developed. The method was applied for the development of immunoaffinity chromatographic devices as well as for direct sample monitoring. The recent advances in agrochemical monitoring in view of the above developments will be introduced.

219. Analysis of environmental contaminants by rapid chromatographic immunoassays and on-line immunoextraction

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The selective ability of antibodies to bind a given target has made these reagents popular in clinical and biological analysis for many decades. This has led to similar work in recent years in the use of antibodies for the analysis and extraction of environmental agents. The combined use of antibodies in HPLC systems to produce automated chromatographic-based immunoassays and immunoextraction methods has been shown to be a powerful tool for such work. This presentation will discuss the principles of these methods and consider several recent examples of their applications in the analysis of herbicides and other environmental contaminants. This will include an examination of the parameters that are important to consider in the design and use of such techniques and the various formats in which these methods can be employed. The possible impact on these methods by new developments in related fields, such as the creation of monolithic supports and synthetic or biological mimics of antibodies, will also be considered.

220. Immunoaffinity chromatography coupled with LC-MS for the identification and determination of pyrethroids and 3-phenoxybenzoic acid in environmental samples

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A single immunoaffinity chromatographic (IAC) column was developed for screening both pyrethroids (permethrin, cypermethrin, deltamethrin) and the metabolite 3-phenoxybenzoic acid (3-PBA) from complicated matrices. Solid and semi-solid samples (soils and food) are pre-extracted with enhanced solvent extraction (ESE) or supercritical fluid extraction (SFE) before application of IAC screening to the pyrethroid and 3-PBA analytes. Liquid samples (water, urine), however, can be directly analyzed on the IAC column without pre-treatment or with a simple pre-treatment with acid. LC-MS (APCI ion source, quadruple mass analyzer) is employed for individual identification and quantification of the analytes eluted from the IAC column. Isotopically labeled 3-phenoxybenzonic acid (phenoxy-$^{13}C_6$) was used for quantitation. Enzyme-linked immunosorbent assay (ELISA) methods were also employed and compared with the IAC-LC/MS method for the analysis of pyrethroids and 3-PBA. Notice: Although this work was reviewed by EPA and approved for publication, it may not necessarily reflect official Agency policy. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

221. **Application of immunoassay using monoclonal antibody in the field of agrochemicals**

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\The immunoassay system using monoclonal antibodies (MAbs) is not so familiar against naturally occurring bioactive compounds having smaller molecular weight, although it is now indispensable to various investigations. Quality control of the traditional Chinese medicine (TCM) is necessary because it is believed that approximately 70% of these crude drugs prescribed are collected from natural sources. We succeeded the double staining of ginseng saponin, ginsenosides indicating that ginsenoside Rg1 and GRe were stained as a purple color and the others did blue separately. From this result, both antibodies can distinguish individual aglycones, protopanaxatriol and protopanaxadiol. For this application, the crude extracts of various Panax species were analyzed by the newly developed double staining system. On the other hand, the Rf value of ginsenoside roughly reflects the sugar number attached to the aglycon. From these results, it makes it possible to suggest which aglycon is conjugated and how many sugars are combined leading to the structure of ginsenosides. An immunochromatographic strip test was developed for detecting sennoside A and B. The assay is a competitive immunoassay that uses anti-sennoside A and B MAbs and a detector regent that contains colloidal gold particles coated with anti- sennoside A and B MAbs. Detection limits are 125 ng/mL individually.

222. **Affinity purification of antibodies to hydrophobic and hydrophilic pesticides: Generic elution techniques and assessment methods for preparative scale chromatography**

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Functionally and structurally pure antibodies to priority agrochemical residues are required for the construction of modern rapid assay and sample processing methods. A relatively simple procedure for the isolation of large quantities of pure and stable IgG antibody fractions from polyclonal antisera has been demonstrated using model antibody-hapten systems of several chlorophenols and triazines. The optimised procedure enabled the isolation of 50-200 mg quantities of antibodies. The optimisation required improvement of the critical phases: treatment of antisera, high capacity absorption hapten-Sepharose gels and a judicious choice of elution mixtures. Elution of antibodies to hydrophobic and hydrophilic haptens required different elution conditions indicating the involvement of binding forces dictated by the chemical properties of the hapten. The elution conditions were based on mixtures of organic solvents and either acidic or alkaline additives. In most cases, the absorption of detectable antibodies by the affinity gels and recovery were in excess of 80%.

223. **Quality assurance and validation with immunoassays**

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Immunoassay has proven to be an invaluable research tool in environmental screening for agrochemicals. Also the application of immunochemical techniques in the food safety sector is booming, especially for detecting the natural "agrochemicals" group of mycotoxins. On the other hand, official recommendation of the use of immunoassays for environmental control, water quality monitoring, and surveillance of waste water processing is scarce. This is due to a still missing consensus on how to assess precision, accuracy, and detection limits and how immunoassays should be validated. Though basic ideas exist, especially in the field of clinical chemistry, most concepts have not been implemented in environmental laboratories. Benefits of using robust statistics, precision profiles, power curves, and control charts will be demonstrated. Examples for critical QA issues to be addressed by any report on immunoassays as well as concepts for in-house validation will be presented.

224. **Assessment of an improved enzyme-linked immunosorbent assay (ELISA) and a novel LC-MS method for urinary atrazine mercapturate analysis**

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Two methods for urinary atrazine mercapturate (AM) analysis, immunoassay and LC-MS, are reported in this paper. The sensitivity of the immunoassay (ELISA) was improved 10-fold by eliminating interfering substances by solid phase extraction (SPE) prior to analysis. The mixed-mode Oasis® MCX resin gave good recoveries (82%) of AM in spiked samples. At relatively high concentrations of urinary AM (higher than 20 ng/mL), sample dilution was effective enough for the elimination of interfering substances. The new LC-MS method developed for AM utilizes online-SPE with Oasis® HLB, column switching and a stable-isotope internal standard, and has a limit of quantification of 0.05 ng/mL. Analysis of urine samples from farmers exposed to atrazine (n = 70) revealed good agreement (R^2 = 0.917) between the log normalized data from ELISA+SPE and LC-MS, which suggests that both methods are suitable for the analysis of urinary AM as a biomarker for human exposure to atrazine.

225. **Evaluation of an enzyme-linked immunosorbent assay (ELISA) for monitoring 3-phenoxybenzoic acid in urine**

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Synthetic pyrethroids are among the most frequently used pesticides in the United States. Several of these compounds are metabolized by humans to 3-phenoxybenzoic acid (3-PBA). Thus, 3-PBA is commonly used as a nonspecific biomarker of pyrethroid exposure. An enzyme-linked immunosorbent assay (ELISA) was evaluated for the determination of 3-PBA in human exposure urine samples. The optimized reagent concentrations for the solid-phase ELISA were: coating antigen (0.5 ng/mL), anti-PBA antibody (1:4000) and enzyme conjugate (1:6000). Two different sample preparation procedures were used for the ELISA and GC/MS methods. The sample preparation methods employed for the ELISA consisted of hydrolyzing the urine sample with concentrated HCl, extracting the mixture with dichloromethane, and a solvent-exchange into 10% methanol in phosphate-buffered saline. The average IC_{50} value was 1.50±0.36 (24%). The percent relative standard deviation of the 96-microwell plate triplicate analyses of the urine samples was within ±30%. Quantitative recoveries of 3-PBA were obtained for spiked urine samples by ELISA ranging from 70 to 117%. Quantitative recoveries (>90%) of 3-PBA were also obtained by the GC/MS procedure. The immunoassay and GC/MS data were highly correlated suggesting that the ELISA could be useful for quantitatively monitoring 3-PBA concentrations in exposure samples. Notice: The US EPA through its Office of Research and Development funded and managed the research described here under EPA Contract 68-D-99-011 to Battelle. Although this work was reviewed by EPA and approved for publication, it may not necessarily reflect official Agency policy. Mention of trade names or commercial products does not constitute an endorsement or recommendation for use.

226. **Development of a fluorescence polarization immunoassay for the organophosphorus pesticide pirimiphos-methyl**

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A fluorescence polarization (FPIA) based on a monoclonal antibody (MAb) for the determination of Pirmifos-methyl (PIM) was developed. Two fluorescein labeled PIM derivatives were synthesized and several Mabs were produced. The best combination of tracer-antibody was found and FPIA was optimized for direct detection of PIM in water and methanol extract from food samples. The developed FPIA had a dynamic range for PIM from 5 to 200 ng/mL with IC_{50} value of 30 ng/mL and a detection limit of 3 ng/mL. The method was characterized by high specificity and reproducibility. Cross-reactivity with other organophosphorous (fenitrothion, parathion, malathion, methidathion, fenthion, chlorpyrifos) and another pesticides (atrazine, simazine, 2,4-D) were negligible (<0.1%). Recoveries for the spiked barley samples at 30 and 60 ng/mL levels were in a desirable range of 90-112%. Results of PIM determination in barley were compared to those determined by ic ELISA. The FPIA method can be utilized for high-throughput screening of food samples for PIM residues without a complicated clean-up.

227. **Legacy pesticides in North American air: Long-range transport or "ghosts of the past"?**

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Most organochlorine pesticides (OCPs) have been deregistered for several decades in Canada and the U.S., but residues persist in agricultural soils. Here we show evidence that volatilization of these residues presents an ongoing source of atmospheric contamination. Concentrations of OCPs in air sampled directly over soils in the U.S. and Canada were elevated compared to ambient air levels. Fluxes of DDTs from a field in southern Ontario last treated three decades ago were estimated using micrometeorological techniques. A coupled soil/air exchange - atmospheric advection model predicted air concentrations above southern U.S. soils which agreed with measured values. Chemical markers such as ratios between parent/metabolite compounds, isomers and enantiomers can be used to distinguish soil emissions from other sources; e.g., chlordanes from termiticide applications. Quantifying soil emissions is necessary to place long-range transport contributions (e.g., from Mexico and Asia) into perspective. An example for DDT is presented.

228. Wet and dry atmospheric deposition of pesticides in the San Joaquin Valley, California

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Wet and dry atmospheric deposition samples were collected at six sites in the San Joaquin Valley, California over 2.5 years. Wet deposition samples were collected from individual rain events; dry deposition samples were composites collected over periods of three weeks to four months. Samples were analyzed for 41 currently used pesticides and 23 degradates, including the oxygen-analogs of nine organophosphorus insecticides. Ten compounds in rainfall and 19 in dry deposition were detected in at least 50% of the 157 samples collected. Dacthal, pendimethalin, simazine, trifluralin, chlorpyrifos, diazinon, and carbaryl were the most frequently detected pesticides in both rainfall and dry deposition. Trends observed between wet and dry deposition were related to the Henry's law value of each compound. Rainfall was a greater source of depositional loading for compounds with low Henry's law values such as diazinon (0.04 Pa m^3/mol), while dry deposition was the more predominant depositional pathway for compounds with higher Henry's law values such as chlorpyrifos (1.1 Pa m^3/mol).

229. Pesticide concentrations in rainfall and resulting runoff

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Wet and dry deposition and soil-runoff samples were analyzed for 41 currently used (2001 – 2004) pesticides and 23 degradates at an urban and agricultural site in the San Joaquin Valley, California. One objective was to determine if pesticides introduced to soil by dry deposition were mobilized by runoff during rainfall. A box containing native soil was placed at each site from which surficial runoff samples were filtered and collected sediments analyzed. Nine of 36 rainfalls had sufficient intensity to cause runoff. Eight pesticides were frequently (>50%) detected in runoff water, whereas 12 were detected in rainwater. Seven pesticides were detected in suspended-sediment samples, but only diazinon, metolachlor, pendimethalin, and simazine were present frequently (>40%) and mainly at the agricultural site. Pesticide concentrations in rain at the agricultural site generally were equivalent to or greater than at the urban site. Herbicide concentrations in runoff generally were greater than in rain, whereas insecticide concentrations in runoff were nearly equivalent to rainfall.

230. Pesticides in the atmosphere of the Delmarva Peninsula

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The Delmarva Peninsula, within the Chesapeake Bay watershed, is a region of intense agricultural activity with up to 44% of the land area under cultivation. In a three year study, daily precipitation samples and 24-h weekly air samples were collected to study the effects of local agricultural activity and rainfall patterns on the deposition of pesticides used in this region. Our results illustrate that different classes of pesticides respond differently to rainfall patterns reflecting their chemical properties and application patterns. More soluble herbicide fluxes are dependent upon the timing of herbicide application as well the frequency and distribution of rainfall events relative to application. More volatile insecticide and fungicide fluxes are more diffuse and continuous throughout the year, reflecting their environmental persistence. Our results also illustrate that herbicides on the particles in the atmosphere appear not to have reached equilibrium with the surrounding air and deviations are larger during application time.

231. Atmospheric transport and deposition of pesticides in south Florida

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South Florida is a unique combination of highly productive agricultural lands, expanding residential development, and critical terrestrial and aquatic wildlife habitat whose ecosystem health is declining. The subtropical climate (high temperature and humidity), frequent rain events and irrigation, low organic soils, and shallow water table, which is controlled by the canal flood gates, facilitate the movement of pesticides from soil, plant, and water surfaces to the air. During 2002 – 2006, biweekly air and event-based rain samples were collected at three locations in South Florida: 1) Tropical Research and Education Center, University of Florida in Homestead, Florida which is surrounded by agricultural production and older homes and newly-built residential developments; 2) Adams Key in Biscayne National Park, part of the Emerald Keys with the Atlantic Ocean on the east and Biscayne Bay on the west; and 3) Daniel Beard Research Center in the northeast quadrant of Everglades National Park. Each site was also equipped with a weather station, and generally, evapotranspiration was equal to and sometimes greater than precipitation. Samples were analyzed by GC/MS for currently-used pesticides, and as expected, the highest concentrations were observed at Homestead. Maximum pesticide concentrations for endosulfan, diazinon, chlorpyriphos, atrazine, and malathion were 90, 90, 16, 1.4, and 1.0 ng/m^3, respectively, for air. The presence of diazinon and malathion indicates an urban contribution to the total atmospheric pesticide load in this region. Of particular note is endosulfan which is applied to crops in a 7:3 α:β mixture, however, in most studies, the α-isomer is observed at 10 - 100 times greater because β-endosulfan readily isomerizes to α-endosulfan as opposed to volatilizing. Occasionally, in this study, the isomeric ratio was nearer to 7:3 which suggests that drift may be the primary route to the atmosphere and not volatilization.

232. Spray irrigation of treated municipal wastewater as a potential source of atmospheric PBDEs

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Spray irrigation facilities utilizing treated municipal wastewater are a potential source of polybrominated diphenyl ethers (PBDEs) to the atmosphere. PBDEs are used as flame retardants in many household items and have been found in wastewaters and biosolids. Evidence of PBDE release from spray irrigation facilities was discovered during a multi-year project to measure semi-volatile organic chemical concentrations in air. Four BDE congeners (47, 99, 100 and 154) were monitored at three remote/rural locations in Maryland and Delaware from 2001-2003. Average concentrations at two of the sites (BDE 47: 10-17 pg/m3; BDE-99: 5.3-7.7 pg/m3) reflect background levels. Average concentrations at the third location were 5-10 times higher (BDE-47: 175 pg/m3; BDE-99: 26 pg/m3) and were significantly correlated ($p<0.0001$) with temperature indicating local source(s). Several spray irrigation facilities are located to the south and west of the third site, the prevailing wind direction during the spring and summer when most samples were collected. The fine mist released from the irrigation equipment may enhance release to the atmosphere via air-water gas exchange from water droplets. Temporal trends indicate that aerial concentrations of PBDEs in this area are increasing at an exponential rate; the atmospheric doubling times for the different congeners range from 1.1-1.7 yrs.

233. Evolutionary approaches for addressing antibody selectivity, affinity, and stability

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Antibodies are one of the crucial determinants for the analytical performance of immunosensors. In this lecture, various types of libraries are presented as a primary source for the production of recombinant antibodies. From these libraries, selective binders were isolated for pesticides, genetically modified organisms (GMO), and pathogens by applying the Darwinian principle of variation and selection *in vitro*. Employing initial binders as a template, various evolutionary strategies were subsequently tested in order to generate improved antibody variants. Randomized point mutations combined with sequential recombination of variable antibody gene repertoires resulted in the most significant shift of the equilibrium dissociation constant, K_D, from 1.3×10^{-8} M of the template to 7.5×10^{-10} M of the optimized variant. In addition, stability can be considered in antibody engineering to warrant antibody functionality even under unfavorable conditions. Our results indicate that temperature stability can be attributed to the sequence of particular antibody families.

234. Development of monoclonal antibodies specific for ricin

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Ricin is a dichain ribosome-inactivating protein from the beans of *Ricinus communis* (castor), and has been used for experimental cancer chemotherapy as well as for intentional poisoning. It is enriched in the extracted mash of castor beans following the recovery of castor's high quality industrial lubricant. There is a need for analytical methodology to quantify ricin in both castor extracts and food matrices. We developed monoclonal antibodies to ricin, derived from mice that had been inoculated with the nontoxic, isolated A or B chain. Most of the antibodies showed strong cross-reactivity with RCA-1, an agglutinin homologous to ricin, but having an altered B chain and a different quaternary structure; one antibody bound RCA-1 selectively. These antibodies have proven effective in various ELISA formats, with IC_{50}'s in the range of 10-100 ng/mL. The ELISA results will be presented in comparison to the results of commercialized assays and bioassays.

235. Development of new monoclonal antibodies specific for *Botulinum* neurotoxin type A

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Clostridium botulinum neurotoxins (BoNT) cause severe neuroparalytic disease and are considered the most toxic biological agents known. While botulism is rare in the US, it often is fatal if not treated quickly, and recovery is long, requiring intensive treatment. BoNT is produced as a single 150 kDa precursor, which is cleaved to form two subunit chains linked by a single disulfide bond. BoNT detection relies on the mouse bioassay. Although it is time consuming (up to 4 days) and lacks specificity, it gives a sensitivity of ~10 pg/mL, and most BoNT immunoassays are much less sensitive. In this study, we describe the development of new monoclonal antibodies (MAb). These are IgG1 subclass MAb with kappa light chains that specifically bind BoNT type A. Western blot analysis demonstrated that they bind the 100 kDa heavy-chain subunit, but not the 50 kDa light-chain. Further characterization of these MAb and their application to rapid immunoassay formats will be discussed.

236. Aptamer ligands for agrochemical applications

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To date, several bio-analytical methods have used nucleic acid probes to detect specific sequences in RNA or DNA targets through hybridisation. More recently, specific nucleic acids, aptamers, selected from random sequence pools, have been shown to bind non-nucleic acid targets, such as small molecules or proteins. The development of *in vitro* selection and amplification techniques has allowed the identification of specific aptamers, which bind to the target molecules with high affinity. Many small organic molecules with molecular weights from 100 to 10000 Da have been shown to be good targets for selection. Moreover, aptamers can be selected against difficult target haptens, such as toxins or prions. The selected aptamers can bind to their targets with high affinity and even discriminate between closely related targets. Aptamers can thus be considered as a valid alternative to antibodies or other bio-mimetic receptors, for the development of biosensors and other analytical methods. The production of aptamers is commonly performed by the SELEX (Systematic Evolution of Ligands by Exponential Enrichment) process, which, starting from large libraries of oligonucleotides, allows the isolation of large amounts of functional nucleic acids by an iterative process of *in vitro* selection and subsequent amplification through polymerase chain reaction. Aptamers are suitable for applications based on molecular recognition as analytical, diagnostic, and therapeutic tools. In this review, the main analytical methods which have been developed using aptamers, will be discussed together with an overview on the aptamer selection process.

237. Development of targeted affinity reagents by selection, amplification, and selfassemblage of phage fusion proteins

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Filamentous phages are thread-shaped bacterial viruses. Their outer coat is a tube formed by thousands of equal copies of the major coat protein pVIII. Libraries of random peptides fused to pVIII domains were designed and used for selection of phage probes specific for a panel of test antigens and biological threat agents. Because the viral carrier in the phage-borne bioselective probes is infective, they can be cloned individually and propagated indefinitely without need of chemical synthesis or reconstructing. As a new bioselective material, landscape phages combine unique characteristics of affinity reagents and self assembling proteins. Biorecognition layers formed by the phage-derived probes bind biological agents with high affinity and specificity and generate detectable signals in analytical platforms. The performance of phage-derived materials as a biorecognition interface was illustrated by detection of *Bacillus anthracis* spores and *Salmonella typhimurium* cells. With further refinement, the phage-derived analytical platforms for detecting and monitoring numerous threat agents may be developed, as phage interface against any bacteria, virus, or toxin and may be readily selected from landscape phage libraries. As an interface for field-use detectors, they may be superior to antibodies, since they are inexpensive, highly specific and strong binders, and resistant to high temperatures and environmental stresses.

238. Glucosinolates and cyanohydrins as potential methyl bromide replacements

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Naturally occurring glucosinolates, from mustards, rapeseed, and crambe have exhibited insecticidal activity. Their efficacy is a function of their aglucones, which are volatile and demonstrate insecticidal fumigant properties. Quantitative structure-activity relationships have been developed for the insecticidal potency of the natural glucosinolate aglucones and some synthetic analogs. Naturally occurring cyanohydrins, from flax, cassava, and peas have demonstrated excellent activity as fumigants against insects. Structurally related analogs and derivatives are also highly effective. They are also excellent nematicides and are effective against weed seed germination. An examination of their mode of action will also be discussed.

239. Caffeine formulation for avian repellency

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Caffeine has been previously observed to reduce bird depredation of agricultural products in feeding studies. Trials were initiated to evaluate a formulation of caffeine applied to rice as a repellent under field conditions. To support this effort, methods for analysis of caffeine on ripening rice and on rice kernels were developed using reverse phase high performance liquid chromatography. The details of these methods will be discussed. Initially, these methods were applied to a caffeine formulation in 2 feeding experiments conducted to determine efficacy in reducing rice consumption among 75 red-winged blackbirds (*Agelaius phoeniceus*) in captivity. They were then used to quantify caffeine residues among ripening rice plots (southwestern Louisiana) treated with 0, 1.1, 2.2, or 4.5 kg/ha of our repellent formulation to reconcile aerial application rates and efficacy data. In addition, residue analyses were conducted during germination experiments to evaluate the potential phytotoxicity of various caffeine formulations under controlled environmental conditions. The optimized formulation developed as a result of these studies has increased the repellency of caffeine treatments, enhanced the solubility of tank mixtures, provided water resistance of the treatment, and limited the phytotoxicity of seed treatments.

240. Monoterpene activity against insects

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Botanical insecticide and repellent chemistries offer promising alternatives to currently used synthetic chemicals for management of insect pests. Past studies in the ISU Pesticide Toxicology Laboratory have identified several monoterpenoids with toxic activity against stored product and urban pests. Some of the volatile monoterpenes are also good spatial repellents and might be utilized differently in pest control. Sesquiterpenes exhibit different characteristics which also influence insect activity, most effectively as contact irritants. Mixtures that include both monoterpenes (which provide good spatial repellency) and sesquiterpenes (which provide good contact repellency) result in excellent efficacy via both modes of action and offer potential for residual repellency from a natural product.

241. Inhibition of fungal biofilm formation using quorum sensing chemicals

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Fungal biofilms, a common mode of microbial growth, are colonies of microbial cells encased in self-produced organic layers and are highly resistant to commonly-used fungicides. Biofilm formation is initiated by small diffusible signaling molecules that accumulate in the extracellular environment which are essential for quorum requirements. When a signal accumulates to a threshold concentration, the response regulator is activated within the local population of cell, leading to biofilm formation. In this study, a group of 25 diverse mono- and sesquiterpenes were evaluated to determine their role as quorum sensing inhibitors. Various concentrations of the chemicals were bioassayed for inhibition of biofilm formation using six genera of fungi (*Aspergillus*, *Penicillium*, *Rhizopus*, *Saccharomyces*, *Cryptococcus*, and *Candida*). Farnesol and nerol were among the most active terpenes in inhibiting the quorum sensing mechanism.

242. Natural product based amides against Formosan subterranean termites (*Coptotermes formosanus*)

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As part of a collaborative research project in search for natural product based termiticides to control Formosan Subterranean Termites, we have utilized two approaches. Plants produce secondary metabolites as part of natural defense mechanism to defend from insects, bacteria, fungi, and other plants that are competitors. We, therefore, postulate that investigation of plant extracts would be a suitable approach in order to find environmentally friendly termiticides. The other approach utilized was to investigate already known insecticides via synthesis of libraries of known natural product based insecticides to gain insight to the structure activity of termiticides. Amides are known for their insecticidal activity and the plant family Piperaceae is known for bioactive amides. In order to search for biodegradable, environmentally friendly natural products with minimal mammalian toxicity, *Piper nigrum* extract was investigated. In a filter paper based bioassay for termiticides, piperin, the major constituent in the CH_2Cl_2 extract did not show termiticidal activity. Guineensine, a minor constituent isolated from the same extract, caused >90% mortality of the termites at 1 % wt/wt application. Based on these results a series of amides were synthesized and evaluated. Some of these analogs showed 100 % mortality of the termites at 1 % wt/wt application. Some of these synthesized amides are true natural products occurring in other plant families. Isolation, synthesis and bioassay results will be discussed.

243. Synthesis and evaluation of petuniasteroid analogs

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Petuniasterone D is one of a series of natural orthoesters containing insecticides isolated from *Petunia* plants at the Albany USDA laboratory. These compounds were previously shown to be antagonists of the $GABA_A$ neuroreceptor. SAR studies were carried out using naturally occurring compounds. Using a biomimetic synthesis, a series of synthetic analogs were generated to systematically evaluate structure activity relationships. Analogs were generated which had alternative orthoacyl groups, simplified steroidal nuclei, and stereoisomeric bicyclic orthoesters. These were tested for antifeedant activity in leaf disc choice bioassays using 2nd, 3rd and 4th instar cabbage loopers (*T. ni*). The (*22S,24S*)-isomer of petuniasterone D, was most potent in this bioassay.

244. Synthesis and evaluation potential of nestmate recognition cues in the Argentine ant (*Linepithema humile*)

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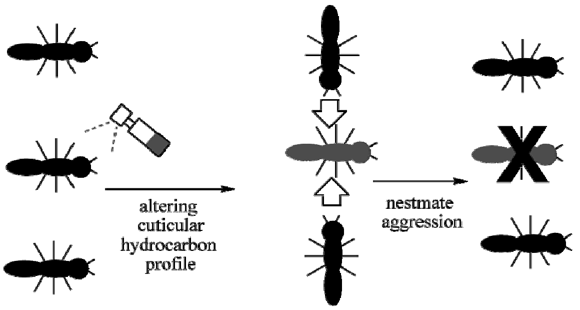
Nonnative species caused approximately $137 billion per year in ecological damage and loss in the United States. Among these foreign species is the Argentine ant, *Linepithema humile*, which is native in South America and has been introduced to Mediterranean climates worldwide. In its introduced range, intraspecific aggression is greatly reduced, colony boundaries are dissolved, and individuals mix freely among physically distinct nests leading to the formation of extensive supercolonies. To understand the mechanisms underlying this social structure, it is important to elucidate the nestmate recognition system in this species. In social insects, recognition cues are chemical in nature and contained in the lipid layer on the cuticle. In Argentine ants, the cuticular profile is composed mainly of linear hydrocarbon molecules of 33 or more carbons with at least one side chain methyl group. The goal of this research is to synthesize pure hydrocarbons believed to be responsible for nestmate recognition and test the effects on ant recognition. Linear hydrocarbons of 35-37 carbons with one to three methyl group side chains were synthesized. The ants were coated with known hydrocarbons identified as potential key elements in intercolony recognition (Figure 1). The ants' reactions were observed to a treated nestmate. While treatment with synthetic control alkanes did not cause an aggressive response, ants treated with synthetic versions of the candidate compounds were attacked by their nestmates. Identification of the essential hydrocarbons for nestmate recognition can permit control over aggression between nestmates by altering cuticular hydrocarbon profile. If successful, this could enable better control over this pest.



245. Evaluating the use of trans fatty acids for determining anthropogenic food sources in the diet of bears

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Establishing the prevalence and behavior patterns associated with the consumption of anthropogenic foods by bears (*Ursus* sp.) is a significant wildlife management issue. To evaluate the feasibility of using bear fatty acid profiles for detecting anthropogenic food sources in the diet of bears, captive bears were fed a control diet or a diet supplemented with margarine containing the trans fat, Elaidic Acid (C18:1n9t). Tissue samples (muscle, subcutaneous fat, and blood) were periodically collected over a three month period for fatty acid analysis. The samples were solvent extracted using a modified Folch procedure and methyl esterified for subsequent gas chromatography/mass spectrometry analysis. Elaidic Acid was detected in the blood of a bear fed margarine daily, over a period of two weeks. Based on this result, tissues samples collected from 21 bears involved in wildlife management activities were analyzed for the presence of trans fatty acids. In 12 of the bears, trans fatty acids were detected at levels interpreted as indicating a significant anthropogenic food component in the diet.

AUTHOR INDEX

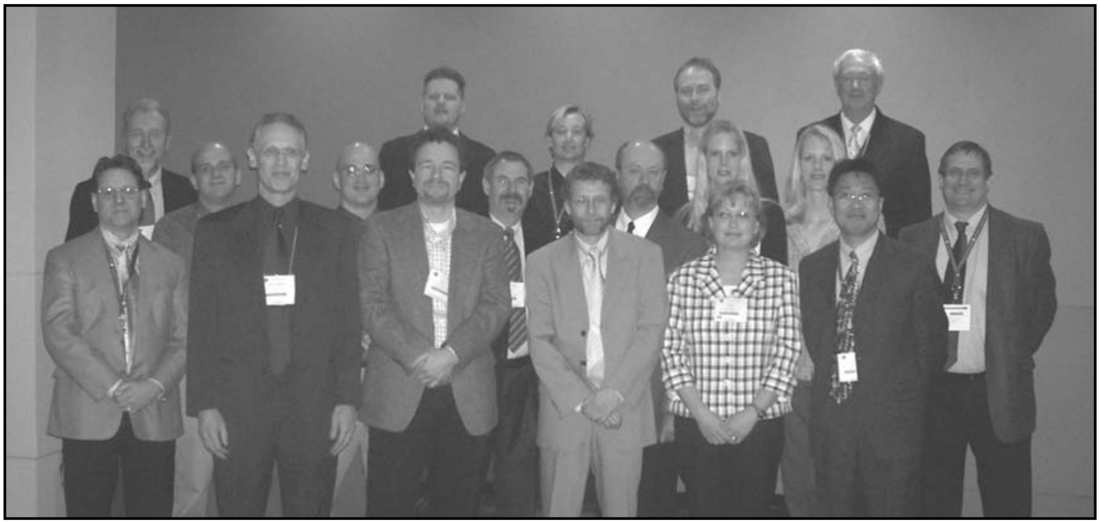
AGRO SCRAPBOOK

Darla and
the Little
Rascals

These folks are having way too much fun!

Is this Pat or is this Pam?

AGRO SCRAPBOOK



The Serious JC Crew

A toast to Joel!

Not bad for an organic wine!

Are they really talking about science?

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-Tim Ballard, tballard@en-cas.com
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