News

UC Agricultural Health & Safety Center at Davis

Spring 2001 Volume 10 No. 3

SEED GRANTS

Center provides start-up funds for 4 projects

Each year the Center provides start-up funds for innovative and pilot projects related to agricultural health and safety issues not currently included in Center activities. Last September, the Center funded the following four projects involving pesticides, farm worker housing and dust exposure through its Seed Grant Program.

Dissemination of a Demonstration Farm worker Housing Model for Migrant Males

In July 2000 construction was completed on a demonstration farm worker housing project for unaccompanied male farm workers in the community of Arbuckle in Colusa County. The housing project, called Villa Almendra, houses 24 men in research-designed, manufactured housing units. A community building on the site, also a part of the project, provides educational- and health-oriented activities for the residents and other farm workers and farm worker families in the area. UC Davis Professor Patricia Harrison designed the housing project with the assistance of other nonprofit organizations and the project owner, a Mexican-American Colusa County farmer. With funding from the Center, Harrison plans to disseminate research findings and demonstration model infor-

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Villa Almendra is a demonstration housing project that will accommodate 24 unaccompanied male farm workers in four separate dwelling units and provides a community building (shown above) for educational, health and recreation activities. The project is unique in that it utilizes research-designed manufactured housing units and is a public-private partnership. The project, designed by Center investigator Patricia Harrison, will be studied continually with respect to its design, performance, management procedures, and educational and health programs. The project is located just west of Highway 5 on private property near Arbuckle in Colusa County.

Foodborne pathogens wreak havoc on our digestive system

Acute gastroenteritis continues to be a serious problem in the United States, invoking much public concern about food safety. Foodborne pathogens are known to cause gastrointestinal illnesses, totaling an annual estimate of 5 million bacterial-related cases and 2.5 million cases related to parasites. Viral infections are predicted to cause more than 30 million cases of gastroenteritis per year.

Robert Mandrell, research leader for the Food Safety and Health Unit of the USDA Western Regional Research Center in Albany, Calif., presented a talk on foodborne pathogens during the Center's Dec. 1 noon seminar. His group's research focuses on pathogens and how they're transmitted to humans through foods we eat. "The more we learn about these organisms and

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mation to interested parties in California and other states for use in developing similar projects. Research findings will include complete descriptions of the project, costs, processes of implementation, planning criteria and issues addressed in the process. Additionally, farm worker resident opinions and community evaluations of the living environment (e.g., design, materials, functional layout), rental costs, health and education programs, and management program will be gathered by the graduate researcher funded by the Center's seed grant. Principal Investigator: Patricia Harrison (paharrison@ucdavis.edu), professor in the UC Davis Department of Environmental Design.

Assessing Ogranophosphate Pesticide Exposure Among Pregnant Women Living in an Agricultural Community and Evaluating Potential Risk to Their Fetuses

Little research has been done to assess the risk of pesticide exposure to pregnant women. The goal of this project is to elucidate the sources, pathways and potential fetal risks of organophosphate (OP) pesticide exposure among pregnant women living in the Salinas Valley of Monterey County. Researchers will 1) collect biological and environmental samples and questionnaire data, 2) analyze specimens for OP pesticides, and 3) conduct a complete statistical analysis to assess the relationships between occupational and environmental factors, pesticide levels in house dust and the urinary OP metabolite levels of pregnant women. The project is designed to assess the potential neuropsychological health risks of prenatal OP pesticide exposure to the developing fetus, based on maternal urinary OP metabolite levels. Principal investigator: Brenda Eskenazi, professor in the School of Public Health, UC Berkeley. (eskenazi@uclink4.berkeley.edu)

Development of a Class-Specific Immunoassay for the Detection of Pyrethroids in the Environment and Humans

Pyrethroids, such as esfenvalerate and permethrin—a group of highly potent insecticides—have been widely used for the control of many common agricultural pests that attack apple and peach orchards, cotton and vegetables. Due to their excellent insecticidal properties and low mammalian toxicity, the use of these compounds has increased rapidly during the last 15 years. In 1998, over 645,000 pounds of active ingredient was applied on various crops in California. Pyrethroids have been detected as surface water contaminants, and are known to be highly toxic to many aquatic animals and amphibious and aquatic invertebrates, which may be exposed to field runoff or drift from aerial and ground-based spraying. Farm workers are at risk for exposure to pyrethroids during mixing and application. Although pyrethroids are claimed to be safe for humans, reversible symptoms of poisoning and a suppressive effect on the immune system have been reported. Therefore, a sensitive and rapid method for monitoring pyrethroids in the environment and for assessment of human exposure is necessary. The goal of this project is development of a class-specific immunoassay for type-II pyrethroids. Since the phenoxybenzyl (PB) group is a common structure feature of most pyrethroids, researchers will use an immunoassay for a compound containing PB for class-specific detection. Researchers will then generate antibodies against a PB-containing hapten and use them to develop sensitive assays. The resulting immunoassay will be optimized and characterized. Principal investigator: Guomin Shan, postgraduate researcher in the UC Davis Department of Entomology. (gshan@ucdavis.edu)

Preliminary Evaluation of Dust Generation System for Exposure Experiment

Many California agricultural operations generate high levels of mixed dust (e.g. organic and inorganic dusts, pesticides, microorganisms, disinfectants, fertilizers, feed additives and combustion products). Preliminary epidemiological studies show a large number of adverse respiratory health outcomes in agricultural workers attributable to agricultural dust exposures. However, researchers have a limited understanding of the causal components and biological activity of the agricultural mixed dust that leads to adverse respiratory effects. In this project, researchers will evaluate characteristics of dust generated from a dust generation

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Ergonomics study aims to reduce work-related disorders

Lower back disorders affect 47 percent of all workers with physically demanding jobs and represent a growing proportion of all Worker's Compensation injury costs.

Research conducted by Center investigator Fadi Fathallah, assistant professor of biological and agricultural engineering at UC Davis, focuses on improving safety and productivity in the workplace by applying occupational biomechanics to understand musculoskeletal disorders.

During his Jan. 5 Center-sponsored presentation, Fathallah described his work with a detection device called the lumbar motion monitor (LMM). This apparatus can be worn like a backpack and mimics the spinal column, while registering the motion of a person engaged in work situations. "This device is three-dimensional," said Fathallah, "If a persons twists, moves side to side, or bends forward, it tracks the motion. It records not only the posture, but also the velocity. How fast the person is moving is important in analyzing the physical risks of a job."

The lumbar motion monitor has application in three major areas: field research, experimental research and clinical research. "In field research we use the device for exposure assessments. It can give you exposure parameters and some information about the risk potential," said Fathallah.

The lumbar motion monitor is motion-based only; it does not measure compression on the vertebrae. Using information from the device, Fathallah measures the motion and the risk factors during a particular task. "We then re-design the work space and re-assess to see if the change we made will reduce the chance for injuries," he said.

During a given task, Fathallah assesses the following five factors:

1. The number of lifts per hour an individual is engaged in a certain activity;
2. The weight of the object being lifted in relation to the distance from the body;
3. The angle between standing and bending positions;
4. The velocity of the twisting movement; and
5. The velocity of the side-to-side movement.

The LMM, which measures the latter three factors, has applications in many agricultural environments. Fathallah explained, "You can put the device on a worker to determine, for example, that the person has been spending 60 percent of his or her time in the stooping position. So you can actually quantify that." He showed application of the LMM in a plant nursery setting, in which a worker was seen picking up pots and carrying them to a cart for transport.

The lumbar motion monitor (LMM), shown above on a vineyard worker, mimics the spinal column, while registering the motion of a person engaged in different work situations.

Fathallah also conducted a study in winegrape vineyards, and the LMM assisted him in making recommendations to growers to reduce the possibility of injuries to their workers.

"My area of interest now is the effect of having two motions occurring at the same time (e.g. twisting and bending) versus examining each factor separately," said Fathallah. "So we're looking at, for example, how much compression of the discs is taking place as well as how much shear."

The LMM device has been used very successfully in clinical applications as a diagnostic tool. "Patients wearing the device are asked to perform numerous motions, and given those parameters, you can determine the likelihood of that producing back pain or another specific diagnosis."

Fathallah serves as principal investigator on a pilot study to assess the feasibility of a new technology to capture multiple exposures in agricultural settings. The project, funded

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how they operate—how they express genes, how they pass from one surface to another and how they communicate with one another—the more we find out that there are many different types of environments they inhabit," said Mandrell. "The reason we don't know a lot about their life in food is because this is

Kathy Keatley Garvey

Research conducted by Robert Mandrell (above) and his colleagues at the Food Safety and Health Unit of the USDA Western Regional Research Center in Albany, Calif., focuses on pathogens and how they're transmitted to humans through foods we eat.

difficult to study. It's an emerging area in food safety."

Due to increased consumer demand and a changing agriculture market, the food production process is evolving in the United States. In recent years, fewer but much larger farms have supplied the bulk of our foods. More pesticides and some genetically modified organisms are being used. Chlorine and other chemicals are being used to disinfect many foods. "Many would say that sanitization is a good thing, and probably in some ways it is a good thing. But the trouble is there are some unintended consequences," said Mandrell.

The most frequent cause of gastroenteritis in the United States is caused by ingestion of *Campylobacter*, a bacterium that is prevalent in poultry, swine and cattle. "It's very important but you don't hear about it because it doesn't cause those big outbreaks like *Salmonella* and *E. coli*," said Mandrell. *Camylobacter jejuni* survives only under specific conditions. "It grows in a very narrow temperature range and requires humidity. We're looking at many aspects of these organisms. The genetics we're getting into with *Campylobacter* are very difficult."

Mandrell discussed a potentially promising study reported by another lab and related to *E. coli* O157:H7 in cattle. He explained, "Shigatoxin 1 belongs to a family of ribosome-inactivating proteins that are found in higher plants and some bacteria. Plants with ribosome-inactivating proteins have potent antiviral activities." Studies have revealed that cattle have prevalent levels of *E. coli* bacteria that produce shigatoxin, which has been shown in the laboratory to inhibit bovine leukemia virus. "So is Shigatoxin an anti-viral in cattle? That's very important to investigate because nobody knows why shigatoxin is really there. We know when it gets inside you it can cause serious illness," said Mandrell.

While nutritionists recommend increasing our consumption of fresh fruits and vegetables, production has increased but so has the use of chemical compounds and irradiation to disinfect foods. Mandrell says he and his group would like to learn more about the biology of food pathogens in order to develop new strategies for assuring food safety. "Many people want to just get rid of everything by disinfection or sterilization," says Mandrell. "But through research, we're just beginning to learn that our immune systems are very much related to the natural microbial flora we get from the things we eat and that we now want to kill."

Mandrell and his colleagues at the Western Regional Research Center in Albany are working on three major projects. They are

- studying how microbes adhere to food surfaces (poultry, produce) and how the organisms actually exist in these environments;
- working on methods for minimizing pathogens in manure used in the food production system;
- working to develop better methods for sampling, detection and identification of these organisms and to find where they occur in nature to learn more about them.

Mandrell, who is lead scientist for the adhesion project, says, "We're working on *Salmonella* in sprouts, *E. coli* O157:H7 in lettuce, *Salmonella* in cilantro, and *Listeria monocytogenes* and *Campylobacter* in other types of produce. We're also interested in gene expression related to the food environment because we'd like to know what the bacteria need to survive," he said.

Many studies have been done on the prevalence of *E. coli* O157:H7 in cattle, but most of the studies revealed very low prevalence. A USDA agricultural research service in Clay Center, Neb., tested about 1,500 carcasses of Midwestern animals coming into the slaughterhouse, of which 28 percent were found positive for *E. coli* O157:H7. "It was up to 200-fold higher than some of the previous studies of prevalence," said Mandrell. It's probably in very low numbers in hamburger

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and most people probably would not get sick from ingesting a few bacteria. However, young children and the elderly may be less tolerant of a pathogen like O157:H7. Also, we don't know if the pathogenic *E. coli* have always been present at those levels or if its level has increased over the years. Now we have very good methods to measure it, and we suspect that it has increased over the years."

Mandrell and his colleagues are also looking at pre-harvest biology, including the methods by which pathogens attach themselves to plants-through possible field contamination and how organisms interact, and they are looking at what happens to pathogens post-harvest such as during transportation or storage.

For more information on Robert Mandrell's work at the USDA, Western Regional Research Center, call him at (510) 559-5829, or send an e-mail to mandrell@pw.usda.gov.

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Artist Javier Juarez (above, left) was guest speaker during the Center's noon seminar in February. Working with Center outreach coordinator Pat O'Conner-Marer (above, right), Juarez illustrated and helped to produce *Proteccion de su Salud,* a comic book format written in Spanish used to help train agricultural workers about pesticide safety. The project was funded by the Western Crop Protection Association (WCPA), and has received national recognition from many groups. Juarez, who was an economist working for the federal government of Mexico for several years before immigrating to the United States, thought the comic book format would be a good means for translating complicated messages in a simple way that people would enjoy. Comic books continue to be a popular form of entertainment in Mexico and, according to Juarez, sales of comic books exceed the sale of any newspaper in Mexico. The first press run of 100,000 copies of *Proteccion de su Salud* was distributed only in California. A second press run of 100,000 is now being distributed in Washington, Idaho, Oregon and Arizona, as well, and is used in conjunction with pesticide training in those states. Juarez claims the most difficult task in developing the comic book was the writing. He says, "It's difficult to translate from one language to another—it's like a Macintosh trying to talk to a PC—they're totally different types of language. It's a lot easier for me to write a briefing paper to the secretary of agriculture than it is to write something with simple language to get a point across to a wide range of people with limited education."

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by the UC Agricultural Health & Safety Center, involves the PimexPlus system, which is capable of capturing up to 32 inputs from a variety of sensors without the need to use wires to collect the data.

Kathy Keatley Garvey

Fadi Fathallah (above) serves as principal investigator on a pilot study to assess the feasibility of a new technology to capture multiple exposures in agricultural settings.

"This system allows us to combine several detection devices with video. So it shows exactly what a person was doing at certain levels the detection devices are monitoring, allowing for a more comprehensive evaluation."

The study is divided into laboratory and field studies. In the laboratory, Fathallah and co-investigators are working with the PimexPlus in a simulated vineyard harvesting operation. In the field, the PimexPlus is applied to workers whose activities are the basis for the laboratory simulation, and investigators perform the same detailed work analysis of their exposures and activities.

If you'd like more information on Fathallah's work, you can reach him by phone at (530) 752-1612, or by e-mail at fathallah@ucdavis.edu.

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system and modify the dust generation system to produce stable and well-characterized dust samples from bulk samples. The success of this project will provide a continuous supply of mixed dust for future exposure experiments evaluating the effects of agricultural mixed dust on lung structure and function. Principal Investigator: Kiyoung Lee (lee@ucdavis.edu), assistant professor in the Department of Epidemiology and Preventive Medicine.

Ongoing projects sponsored by the Center include studies of injury and illness among farmers and farm workers, outreach programs promoting pesticide safety, ergonomics and exposure assessment. More information about the Center's projects is available at http://agcenter.ucdavis.edu/agcenter/.

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CALENDAR

May 4, Noon

TB 137, Davis Campus
Models and Measures of the Pesticide Exposures of Californians
Robert Krieger, Ph.D., Extension Toxicologist, Dept. of Entomology, UC Riverside

June 1, Noon

TB 137, Davis Campus
Emerging Bacterial Zoonoses
Bruno Chomel, D.V.M., Ph.D., Professor of Zoonoses; Director, Dept. of Population Health and Reproduction, UC Davis School of Veterinary Medicine

June 12–14

National Farm Medicine Center, Marshfield, WI
Examining Rural Environments for the Health and Safety of Children
www.marshfieldclinic.org/nfmc/sympsoium2001
(800) 662-6900

July 29–Aug. 1

Sacramento Convention Center, Sacramento, CA
American Society of Agricultural Engineers (ASAE) Annual Meeting. Sessions include Agricultural Safety, Health and Ergonomics. For more (downloadable) information visit http://asae.org/meetings

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