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## Promoting partnerships

ARI networking conference attracts faculty researchers from 18 California State University campuses

**M**ore than 50 faculty members from 18 campuses of the California State University system gathered at the Chancellor's office in Long Beach recently to participate in a conference designed to foster new CSU faculty research partnerships.

The gathering was the first of its kind, hosted by leadership and staff of the California State University Agricultural Research Institute (ARI).

The ARI, which is administered on the Fresno State campus, "is an exemplary illustration of the CSU working

for California and the nation through university-industry partnerships and community engagements," stated ARI Executive Director Joe Bezerra in opening the day-long networking event. ARI is a diverse, comprehensive multi-campus applied agricultural and environmental research program leveraging public funding with external resources to fund research on high-priority issues challenging California agricultural and agribusiness, the environment, and consumer health and safety, he added.

Since its founding in 1999, the ARI program has funded more than 670

peer-reviewed research projects backed by nearly \$60 million in California State, federal and master grant funding, Bezerra reported. Perhaps more significantly – the state and federal funding has been augmented by an additional \$195 million invested by California's agricultural industry, other state and federal agencies and other sources.

The faculty attending the June 7 event came in response to special invitations sent out to all CSU campuses. Several attendees were "veteran" ARI researchers. Most were those who are eyeing new opportunities.

Fresno State associate biology Professor Steve Blumenshine, who has conducted ARI-funded research in the past, said he was impressed by the breadth of disciplines represented by the conference participants.

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# Rice to plastic?

Rice hulls provide glucose needed to form lactic acid, biodegradable plastic

**A** breakthrough process for converting agricultural wastes into highly degradable plastic is drawing attention to the work of a faculty-student research team at Chico State University.

News media have cast them as a group of "brilliant minds." Faculty project leader Joe Greene, professor of mechanical engineering and sustainable manufacturing, says the breakthrough is more a result of simple persistence in research – working with various ideas and developing some into successes.

"Sometimes we're surprised," Greene said of his current rice-to-plastic project. "Often you have ideas and they don't work out."

This one is working, so far. The concept was to develop a new type of plastic that would degrade more easily than the common clear plastics now used almost universally for clear plastic drinking cups and other types of beverage containers.

## Update

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Chico State students Kevin Parsons and Kyle Arnet test the purity of bacterial cultures. Photo by Beiron Andersson. Below: Bacteria form lactic acid in culture dish.



"Plastics are wonderful materials. However, they are an environmental nuisance, in some cases," Greene said. Why? Petroleum-based plastics typically require 50 to 100 years to degrade in a landfill. Plastics made from materials such as corn and starch require much less time, converting to carbon dioxide and water in about six months.

## New application of existing technology

The technology for converting starch into plastic has been in place for a decade, Greene noted. The idea of using an agricultural waste product, in this case rice hulls, is a breakthrough that could greatly benefit the farming industry in central and northern California due to the large rice production in the region.

Working with a team of seven students majoring in biology, chemistry and sustainable manufacturing, Greene developed a four-step process for extracting carbohydrates from the rice hulls and converting them into polylactic acid, or PLA.

The process involves first pretreating the hulls with enzymes to force release of carbohydrates in the form of glucose; secondly, adding bacteria that feed on the glucose, producing a crude form of lactic acid; thirdly,

purifying the crude lactic acid; and finally, using heat to chemically convert the pure lactic acid into PLA.

When dried, the PLA takes the form of a fine white powder. Further processing converts it into pellets so it can be used in commercial equipment and made into clear plastic sheets, and from there formed into a variety of containers.

"We have proved it's technically feasible. Now we need to make it economically feasible. If it works we could partner with a company," Greene said.

Partial funding for this project was provided by the California State University Agricultural Research Institute (ARI), with support also from the California Rice Research Board.

This year, with additional students and ARI funding, Greene is continuing rice hulls-to-plastic research, seeking ways to improve conversion rates of rice straw to glucose, and to streamline the laboratory process.

For more information on this work, Greene may be contacted at [JPGreene@csuchico.edu](mailto:JPGreene@csuchico.edu).

# Farm Bill supports more than agriculture

**A** new omnibus Farm Bill is under construction in the U.S. Congress this summer. The last farm bill was passed in 2008, and since the legislation's lifespan typically covers four years, debate is gearing up for a new bill, reported Mechel Paggi, director of Fresno State's Center for Agricultural Business (CAB).

As lobbyists seek to influence the process, legislators also are seeking input from a variety of sources – including research institutes and professional associations, Paggi said.

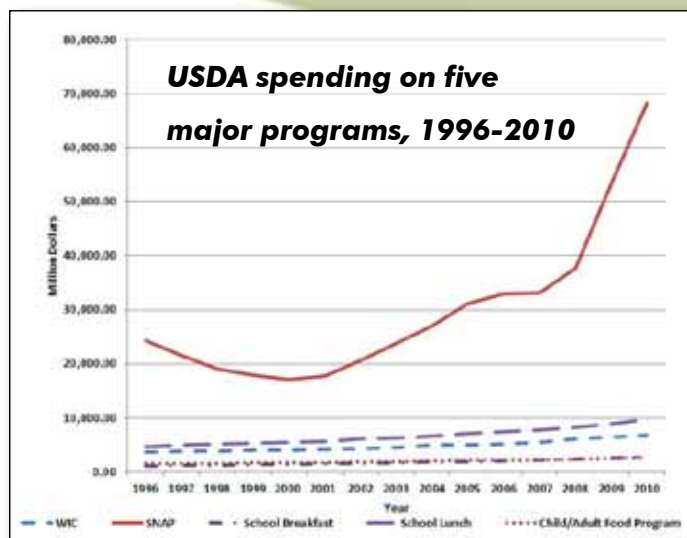
Based on his experience in national economic policy, Paggi was invited to share his insights in "Choices," a national agricultural economics online publication of the Agricultural & Applied Economics Association.

The very first Farm Bill, enacted under FDR in 1933, was designed to aid struggling farmers during the Great Depression, Paggi noted. The bill established support for prices for six basic commodity crops by paying farmers to reduce production.

"Over time, farm legislation has evolved to include programs and policies that address a much wider array of issues than production agriculture and related markets," Paggi states in his article for "Choices."

***"Indeed the majority of federal money allocated to agriculture programs is now directed toward food and nutrition programs," he said.***

For example, in fiscal 2011 it is estimated that about 70 percent of the USDA's budget (contained in the



farm bill) is to be directed to programs such as the supplemental food and nutrition assistance program (SNAP); school lunch and breakfast programs; and the women, infant and children (WIC) program.

This year will present special challenges for crafting the bill because of volatility in the marketplace and the burgeoning federal debt crisis, Paggi said. His advice is to carefully examine the state of "food insecurity" in the United States, including the many nutrition and dietary programs and their effectiveness.

Studies conducted by the USDA's Economic Research Service (ERS) recently reported that 14.7 percent of U.S. households – involving more

than 50 million people – were food insecure at some point in 2009.

While budget concerns will affect the spending allocations in this year's farm bill, "the environment in which the new

legislation will be debated is going to be dominated by the desire to provide a safety net for American agriculture and to maintain the provision of effective food assistance programs," Paggi said.

The effectiveness of programs such as SNAP and WIC must be carefully evaluated before funds are systematically doled out, he warned.

And as is typically the case, the legislation will require support from a broad array of legislators, representing both rural areas dominated by farming and urban centers.

"In the future, objectives focused on achieving specific health and nutrition targets might be better achieved by delivering programs through different government agencies," Paggi said. That level of change is unlikely to occur for the 2012 farm bill, however, he said.

For more information on the article or on agribusiness research conducted by CAB, contact Paggi at [mpaggi@csufresno.edu](mailto:mpaggi@csufresno.edu).

## Upcoming events

**Nov. 10** – 30th Annual Agribusiness Management Conference at the Radisson Hotel and Conference Center in Fresno, California. For more information, call 559-278-4405.

For more information on these and other upcoming events related to agricultural business and labor, visit Fresno State's Center for Agricultural Business website at <http://www.csufcab.com>.



## Project aims to reduce salinity discharge from wine making, food processing operations

**R**epresentatives of the wine and food processing industries in the central San Joaquin Valley have joined a university research team in a major effort to reduce salt water discharge as a result of plant cleaning operations.

Wawona Frozen Foods Inc. of Clovis and Gallo Winery are partnering with food science Professor Gour Choudhury and Fresno State in a project they believe will have far-reaching impacts on the economic viability of California wineries and the food processing industry.

"Wastewater salinity and disposal issues are raising big questions about the future of wine making and food processing in California because of ever-increasing treatment costs, limited wastewater treatment capacity in some areas, and growing regulatory requirements," Choudhury said in outlining the project.

***"Research is needed to develop technical solutions to reduce discharge of high salinity wastewater."***

Choudhury has teamed with Wawona over the last several years to develop and implement an eco-friendly lye-peeling system that reduces water use and discharge in the firm's Clovis peach processing plant. He has applied the same process, now under patent pending, to tomato processing and is working with industry on commercial applications.

Salinity in wastewater discharge is a separate issue for businesses that do

food processing and wine making, Choudhury said.

"Equipment builds up acids during processing, and sodium hydroxide is the most effective chemical for breaking down those acid residues," he said. "But the process forms salts. Our objective is to reduce high-salinity wastewater discharge and water demand during equipment and plant cleaning."

### Project time line

The project includes two phases: One is to work with an area cleaning product manufacturer to develop "green" chemicals that will clean effectively but reduce salinity discharge. The second phase is to try new mechanical processes that will accomplish the same result.



Fruit processing requires regular cleaning of belts and other machinery.

The project time line is two years, Choudhury said. That will include development of new products and processes, testing their efficacy in the laboratory, and then working

to apply them at the commercial level.

The work was funded by a \$450,000 grant from the California Specialty Crop Block Grant Program. Industry partners have invested more than \$150,000 in grants and in-kind services to support the project.

"The development of green chemistry and cleaning process improvement should significantly reduce salts in the waste stream – a benefit not only to industry, but to municipal wastewater treatment plants, groundwater, communities and to the environment as a whole," Choudhury said.

Results of the work will be shared with table, raisin and wine grape sectors in California, as well as tomato, peach, pear and other food processing operations throughout the state.

Other supporters of the project include the Wine Institute, the California League of Food Processors, the California Sustainable Wine Alliance, and the National Grape and Wine Initiative.

For more information on this project, contact Choudhury at [gchoudhu@calpoly.edu](mailto:gchoudhu@calpoly.edu).

## Canola trials yield seed, oil, feed supplement

**A** comprehensive research study that started with growth trials of salt-tolerant canola using poor quality "West-Side" water has ended with the pressed canola meal successfully used as a selenium-rich feed supplement for cattle.

The work began in 2006 with a research partnership among Fresno State's Center for Irrigation Technology (CIT), a USDA soil scientist, and West-Side farmer and rancher John Diener.

***"Growers on the West Side of the San Joaquin Valley have tried to reduce their production of selenium-laden irrigation effluent and thus sustain agricultural land in central California,"***

stated Gary Banuelos, lead researcher on the project, representing the USDA's Agricultural Research Service based in Parlier, California.

One method of using excess selenium in West-Side drainage water is to apply the water to salt- and selenium-tolerant crops. Several of these crops are in the Brassica family and include canola and mustard.

However, "in order for canola to be widely accepted as a crop and be used to manage the volume and Se content of effluent produced in the West Side, it is imperative that viable economical uses for the harvested plant product be created," Banuelos said in a recent report on the project.

The primary goal of the project was to successfully grow canola using Se-laden drainage water: Over a two-year period at Diener's farm the research team established several 40-hectare plots planted to canola and mustard on farmland southwest of Fresno.



Mechanic Jose Lopez adjusts horizontal oil press during canola and mustard seed processing at Red Rock Ranch.

The test plots were irrigated with water high in selenium, yet the crops still produced a maximum seed yield of 2.2 metric tons per hectare, Banuelos reported. More than 300 tons of Brassica seed have been harvested and processed over the course of the experiment.

### Pressing seed for oil

The second project phase was to press the harvested canola and mustard seed for oil that could be blended with diesel fuel. This was accomplished on Diener's ranch with research funding provided by the California State University Agricultural Research Institute (ARI), the California Department of Water Resources, and the USDA's Agricultural Research Service. The funding enabled purchase of a dry extruder and oil press which was able to extract up to 90 percent of the available oil in the canola and mustard seed.

With cooperation from Russ Teal of Biodiesel Industry in Santa Barbara,

## Water system funding discussed at conference

**C**enter for Irrigation Technology Director David Zoldoske joined Fresno State colleague Karl Longley and about 100 engineers, water district managers, researchers, community advocates and others in a recent conference aimed at helping to bolster water system infrastructure.

The day-long event, held in Rancho Cucamonga June 28, was hosted by the California State University Water Resources and Policy Initiatives Program (WRPI). Zoldoske directs the program, and Longley, dean emeritus of the College of Engineering, serves as project manager.

The conference supported WRPI's larger effort to foster environmental restoration and economic development in disadvantaged communities by improving water infrastructure.

The CSU has proposed to create a federally designated "technical assistance center" to help California's disadvantaged communities develop and manage effective, sustainable water and wastewater systems.

For more information on the WRPI and its work and programs, visit <http://www.calstate.edu/water>.



## Forcing new growth

Viticulture research trials force new bud break later in season, ripening under cooler temperatures

**A** new approach to wine grape growing in California's sizzling San Joaquin Valley could see certain varieties enjoying a more "cool season" climate and producing higher quality wine grapes.

The strategy involves a practice employed in other places but so far not in the valley – called "crop forcing," stated research scientist Sanliang Gu, professor and Ricchiuti Chair of Viticulture Research at Fresno State's Viticulture and Enology Research Center (VERC).

"Wine grapes produced in California's warmer regions amount to 60 percent of tonnage but only 25 percent of crop value," Gu said in outlining his research. "If the growing cycle of wine grapes in warmer regions can be delayed or shifted to the cooler period of the growing season, fruit ripening will occur at lower temperatures, and in turn, much improved fruit and wine quality should be expected."

Grapevines have genetic ability to set and bear fruit multiple times a year under certain conditions, Gu explained. It does not occur under natural conditions but will if buds are "forced" out of dormancy soon after the berries are set, he noted.

The method of forcing new buds is simply to remove the newly-set berry clusters, as well as pruning back shoots and removing leaves and laterals. In some cases, leaves can be retained to provide protection from sunburn.

When these actions are taken, a second bud break quickly follows and



the whole developmental cycle starts anew, Gu said. And since the new cycle starts up to several weeks later, the fruit of the "forced crop" ripens later in the season, generally under cooler temperatures, with characteristics of cool region fruit.



Student technicians join viticulture research scientist and professor Sanliang Gu (right) in special pruning as part of crop forcing project. Left: Close-up view shows clusters that will be pruned to force new bud growth.

In the central San Joaquin Valley, harvest time of some wine grape varieties would be moved from the beginning of September to the middle of November, Gu said.

Crop forcing and even double-cropping of grapes have been employed

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## Paper discusses tannin interaction with plant cell walls

**A** recently published study has shown the importance of berry development on plant cell wall interaction with tannins in grapes and how this interaction could play a role in red wine production.

This study was published in a recent issue of the *Journal of Agricultural and Food Chemistry*, published by the American Chemical Society.

Coauthoring the article were James Kennedy, director of Fresno State's Viticulture and Enology Research Center (VERC), and Keren Bindon, a

research fellow at the Australian Wine Research Institute.

The full article, entitled "Ripening-Induced Changes in Grape Skin Proanthocyanidins Modify their Interaction with Cell Walls," outlines the interaction between skin and flesh cell wall material and the selective adsorption of Proanthocyanidins, which in turn can affect properties of wine during vinification.

For more information on the article or Kennedy's research, contact him at [jakennedy@csufresno.edu](mailto:jakennedy@csufresno.edu).

## Forcing pushes back harvest to November, cont'd. from pg. 6

in Australia and in some tropical areas, respectively, Gu noted. Since hand pruning is labor intensive and costly, however, researchers have experimented with other methods and have found some to be effective. Some of those methods include spraying synthetic and/or natural chemicals and extracts that prompt the vine to break new buds.

Later-season wine grape maturation in the San Joaquin Valley would mean crops with smaller berries, higher acidity, lower pH, deeper color, higher tannins and phenolics, and more intense aroma and flavor – all characteristics that tend to produce higher-quality wines, Gu said.

Since the method is virtually untested in the San Joaquin Valley, many issues must be addressed in experi-

menting with crop forcing, Gu said. In other areas, such as Australia, experiments have shown it can negatively affect vine health, capacity and longevity.

However, "with the knowledge we've gained and the advances we've made during the past 30 years in vine physiology, mechanization of cultural practices, and chemical

defoliation or defruiting, we have the opportunity to address these limitations," he said.

Gu conducted preliminary experiments in vineyard sites at Fresno State and with cooperating industry partners in Madera County in 2009 and 2010. Partial funding was provided by the California State University Agricultural Research Institute (ARI).

The 2010 season provided encouraging results, and Gu is seeking new funding in order to continue the work.

For more information, contact Gu at [sanliang@csufresno.edu](mailto:sanliang@csufresno.edu)

### Upcoming events

**Oct. 20** – Grape Grower Workshop Part III at Fresno State's Viticulture and Enology Research Center (VERC). Berry sensory analysis and training for growers and winemakers, from 4 to 6 p.m. followed by a barbecue. For more information, call 559-618-1856.

For more information on these and other upcoming events related to enology and viticulture, visit Fresno State's viticulture and enology website at <http://jcast.csufresno.edu/ve/>.

## Canola: Selenium levels in blood, milk within safety standards

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the pressed oil was processed and blended with commercial diesel fuel to produce Biodiesel (BD) 20 biofuel. The fuel was successfully used to power 5.9-liter Cummins diesel irrigation booster pumps on Diener's DK Farm.

The final project goal was to produce a nutritious, palatable cattle feed supplement that would meet selenium needs of dairy cattle. Under the supervision of dairy science Professor Jon Robison, feed trials including 72 Holstein and Jersey cows were conducted at the Fresno State Dairy.

"These studies showed that Se-enriched canola and mustard did not significantly increase total blood and

serum Se content in either cow breed," Banuelos said. And while Se concentrations in milk increased, they remained at safe levels.

Additional studies should be conducted to ensure that selenium levels don't rise too high over the long term, Banuelos said. But the initial outlook is encouraging. And the comprehensive results of the project reveal possibilities for new farming methods on the West Side.

"Our testing demonstrated that the coupling of selenium phytomanagement with biofuel production may provide growers with a unique opportunity to increase environmental sustainability in areas with high selenium conditions, and at the same time reduce use of petro-diesel in sensitive parts of California," Banuelos said.

In addition, with the number of dairy cows estimated to be over 1.8 million head in California alone, a large market exists for Se-enriched Brassica feed meal produced from plants grown on the West Side, he said.

For more information on this research, contact Banuelos at [gary.banuelos@ars.usda.gov](mailto:gary.banuelos@ars.usda.gov).



Dairy study of canola meal as a supplement to conventional feed showed an increase in selenium levels in cow blood and milk -- within safety standards.

# Conference: Diverse faculty experience offers broad research potential

from Page 1

"One of the main benefits I saw was bringing together people who might not typically interact due to differences in location and discipline," Blumen-shine said. "I see good prospects for collaboration and great potential to address relevant issues."

Another participant, plant science Professor David Still of Cal Poly Pomona, shared similar thoughts.

"The CSU has a lot of talented researchers in diverse disciplines throughout the system," Still said. "Meetings like this are needed to help facilitate efforts to make everybody aware their expertise can be applied to solving agricultural problems."

## CSU leadership offers support

Several high-level CSU administrative leaders joined the gathering to express support and to encourage faculty to expand their research activities.

Elizabeth Ambos, assistant vice chancellor in the Office of Research Initia-

tive and Partnerships, described the event as "an outstanding opportunity for CSU faculty to network and discuss potential collaborations."

Executive Vice Chancellor Ephraim Smith underscored the need for CSU collaboration with industry, with other agencies, and among campuses to solve today's complex industry and environmental challenges.

Each year about 400 graduate and undergraduate students from across the CSU serve as paid research assistants, Bezerra noted. Many at the graduate level are actively involved in designing and conducting projects which serve as the basis for their thesis work.

ARI research focus areas include water and irrigation technology, production and cultural practices, food safety and nutrition, biotechnology and biodiversity. Areas receiving special emphasis include climate

change and air quality, alternative energy and fuel technologies, and invasive species prevention and eradication.

ARI projects are led by faculty from the colleges of agriculture, natural resources and environmental sciences at six CSU campuses: California State University, Fresno; California Polytechnic State University, San Luis Obispo; California State Polytechnic University, Pomona; California State University, Chico; California State University Monterey Bay; and Humboldt State University. They work with faculty and research scientists from other state, national, and international universities and research organizations.

The ARI annually releases a request for proposals for faculty of member campuses. A CSU system-wide request for proposals also is released annually, along with other opportunities for special funding. Visit the ARI website at <http://ari.calstate.edu> for more information.

Some information for this article was gleaned from the blog *Science & the CSU*, at <http://blogs.calstate.edu/science/>.



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