



Western Center for Agricultural Health and Safety • University of California, Davis

## Human–robot collaboration to improve strawberry picking

By Suzette Smiley-Jewell

California leads the nation in strawberry production, and in 2013 more than 2.3 billion pounds of strawberries were harvested at a value of \$2.6 billion. However, strawberries are a labor-intensive crop, requiring a stooped posture for picking and then lifting and carrying packed flats of fruit down long, narrow strawberry rows to storage/transport vehicles. Walking back and forth along the rows can lead to injury, such as slipping in the muddy furrows, and causes down time spent in transport and not in harvest.

Stavros Vougioukas, Fadi Fathallah and David Slaughter, professors in the UC Davis Department of Biological and Agricultural Engineering, along with Cooperative Extension Specialist Karen Klonsky, have developed a mechanized robot to help with strawberry picking. The “co-bot,” or collaborative robot, is a small machine capable of going up and down a strawberry row to collect full strawberry containers from a worker and then take them to the unloading site at the end of the row. The co-bot would then bring back empty containers to the worker to fill.

The co-bot is designed to fit within the strawberry field furrows by being small and sturdy, with heavy-duty wheels. Current work is to implement predictive dispatching based on a worker's picking rate, which could be communicated to the co-bot from a wearable device, such as gloves, that would monitor worker hand movement. The co-bot would calculate when a worker was just about finished packing the strawberries and then would



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**Co-bot** continued on page 2

## Coccidioidomycosis (Valley Fever) and the farming community

By Suzette Smiley-Jewell and Stephen McCurdy

Coccidioidomycosis is an important infectious health risk in California, especially in the San Joaquin Valley area south of Sacramento, where dusty conditions often occur from weather or farming. Coccidioidomycosis is caused by breathing in *Coccidioides immitis*, a fungus that lives in the soil of the San Joaquin Valley and throughout the Southwest.

Most people infected with coccidioidomycosis have no symptoms and fight off the infection. Symptoms, if they occur at all, are usually limited to a mild flu-like illness commonly known as Valley Fever. However, some infected persons may go on to develop pneumonia, and in a small percentage of cases the fungus can disseminate throughout the body, including to the central nervous system, and may be fatal. The number of coccidioidomycosis cases in California has increased dramatically in recent years, from about 816 cases in 2000 to more than 4,000 cases in 2012 – a nearly five-fold increase. Almost half of those cases occurred in the state's agricultural powerhouse, Kern County. Because farming involves working in dirt and soil that may harbor *C. immitis* organisms,

**Valley Fever** continued on 3

## Goodbye to long-term WCAHS team member José Gutiérrez

This past December, we bade a fond farewell to José Gutiérrez, who first started at WCAHS as a student worker in 2010 and ended as a Community Health Program representative for our heat illness research project.



José Gutiérrez

Gutiérrez planned on becoming a physician and majored in biopsychology and Spanish. However, when introduced to the “research world” through WCAHS, he changed his mind.

Rather than fix a health problem, Gutiérrez saw that he could work to prevent the health problem in the first place by

learning the root cause of the issues.

Gutiérrez did just that while working in the field this past summer on the heat illness project, where his team collected data on the local weather, worker hydration and internal temperature. The farm workers were incredibly thankful to have the research team concerned about their welfare, and this increased their willingness to participate and learn about the signs of heat illness and how to prevent it.

Gutiérrez is now working in Oxnard, Calif., as the coordinator of *Pasos Saludables* – a farmworker wellness program – at Reiter Affiliated Companies, one of the world’s largest berry growers. Reiter is hosting a UC Davis study to test a comprehensive approach to improve cardiovascular health among Latino farmworkers. Gutiérrez will lead a team of health educators and research assistants, as well as maintain communication with the UC Davis based study personnel. While he will be missed, we are excited to see him continue his path in occupation health and safety.

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## Co-bot *continued from page 1*

come to the worker, essentially serving as a courier service.

Of course, 100 percent picking efficiency is not effective long-term because the human body needs to change position and rest or injury results. Thus, Vougioukas and colleagues are also working on ways that the co-bots could reinforce worker breaks and changes in position. Possibilities include the co-bot providing a warning signal that it is time to rest or stopping short of the worker in the strawberry furrow, forcing the worker to walk to the co-bot. Eventually, the

worker may have to walk all the way down the row to the loading station.

Vougioukas is working to make the co-bots inexpensive so that many could be used in a field, thus increasing harvest efficiency and postharvest quality. Harvest aids are the only technically feasible solution to California’s current labor shortage, which constitutes a major threat to the livelihood of this industry. The co-bot is an example of agricultural robotic automation and mechanization that is being developed to strike a balance between productivity and worker safety.

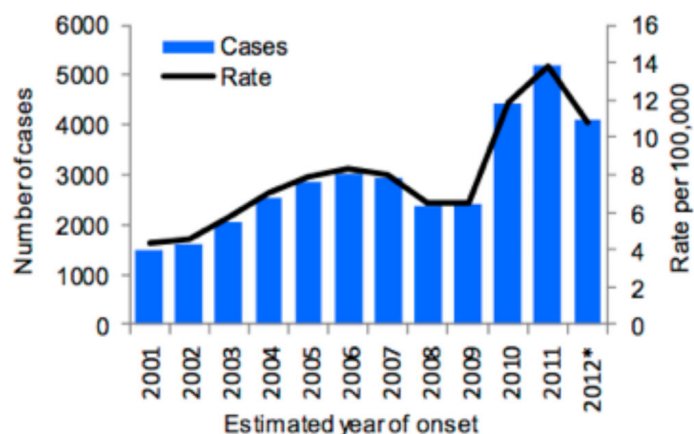


Stavros Vougioukas, an assistant professor in the UC Davis Department of Biological and Agricultural Engineering, is pursuing a four-year project devoted to the development of one of his co-bots.



farmers and farm workers are at potentially greater risk than the general population for contracting coccidioidomycosis. Persons of Hispanic, Filipino, and African-American ancestry

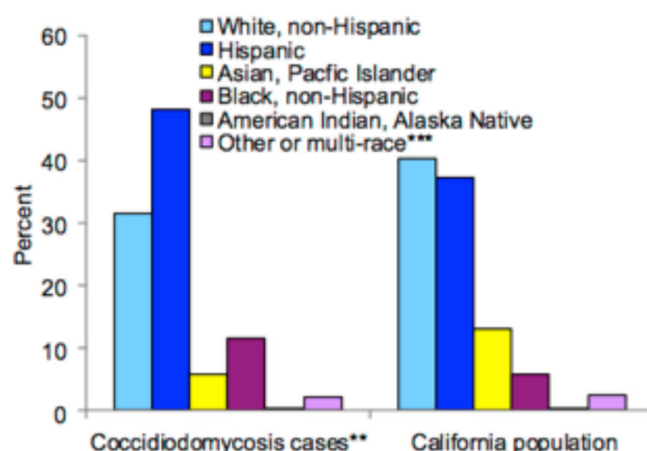
Control and Prevention (CDC) to study the epidemiology of coccidioidomycosis in the farming community of the San Joaquin Valley. They will start by characterizing agricultural workers' current knowledge, attitudes, beliefs, and behaviors about coccidioidomycosis with regard to risk, prevention, recognition and need for treatment. The investigators will also try to determine if exposure to *C. immitis* occurs more commonly from agricultural dusts associated with specific crops and tasks in agriculture. Finally, the investigators will work to identify characteristics of aerosolized soil, such as particle size, associated with carrying *C. immitis*. Results from the study will be used to develop educational material for the farming and medical community and agronomic practices to reduce the risk and health burden of coccidioidomycosis.



California coccidioidomycosis case counts and incidence rates 2001-2012. Source: California Department of Public Health. <http://www.cdph.ca.gov/programs/sss/Documents/CocciEpiSummary09-12.pdf>  
\*Provisional 2012 data as of 4 May 2013

are at greatest risk for dissemination, which is of significant concern because Hispanic immigrant workers from Mexico and Central America represent approximately 90 percent of California's skilled agricultural labor. In addition, persons greater than 60 years of age are at greater risk for severe disease.

Three WCAHS investigators, Drs. Stephen McCurdy and Kent Pinkerton of UC Davis, and Dr. Carol Sipan of UC Merced, have recently been awarded a grant from the Centers for Disease



California coccidioidomycosis cases and population by race/ethnicity 2009-2012. Source: California Department of Public Health. <http://www.cdph.ca.gov/programs/sss/Documents/CocciEpiSummary09-12.pdf>

## Castañeda earns John Muir Institute award for his PM research

WCAHS researcher Alejandro (Alex) Castañeda received the 2014-2015 John Muir Institute for the Environment's White Family Graduate Student Award for his research on the effects of particulate matter (PM) on asthma patients. The White Family Graduate Student Award funds work on resolving environmental inequalities or improving environmental health in California, such as Castañeda's research on air quality issues and asthma in the California Central Valley.

A fourth-year graduate student in the field of immunology, Castañeda has been studying farm workers who are continuously exposed to high levels of air pollution in the San Joaquin Valley. The primary objective of his study is to characterize the mechanisms through which PM enhances allergic responses to house dust mite (a common human allergen) at the genetic, protein and molecular

levels. Through both in-vitro and in-vivo models, the findings of his study have shown that the combination of particulate matter and house dust mite allergen exacerbate inflammation, compared to allergen alone. Air pollution appears to be intensifying the allergic response by activating the immune system in the lung to a greater degree and subsequently recruiting more immune cells to the pulmonary compartment that mediate tissue injury (via oxidative stress) and increase mucus secretion.

The final goal of Castañeda's work is to provide scientific information on the toxicity of air pollution from varying sources and their effects on human health to inform policy makers on the need for improved air pollution guidelines. He presented his research findings at the 2014 International Conference for the American Thoracic Society, as well as five separate conferences/scientific meetings at UC Davis.

New WCAHS Manager Cindy Valencia, M.P.H., joined us in September 2014 from the Central Valley. She aspires to build upon the Ag Center's 25 years of success and work on improving the lives of farmers, farm workers and farm worker communities. California's San Joaquin Valley or Central Valley are often study sites to learn more about air pollution, dust, heat, pesticides and climate change. Valencia was raised in Five Points, California, a farm worker community in Fresno County. Both of her parents were farm workers, and she was the first in her family to receive a masters degree. She has always had an interest in improving health, and her experiences as a public health professional have galvanized her belief in the power of upstream prevention. Strategies of greatest interest include: community engagement, partnership development, communications and translational research. Valencia brings seven years of public health experience managing state, federal and foundation grants. "I think of my father's hands, Five Points and my new journey to work with UC Davis researchers on farm worker health issues – it all finally came together."



From left, WCAHS Associate Director Kent Pinkerton, WCAHS Director of Evaluation Julie Rainwater, WCAHS Manager Cindy Valencia, and WCAHS Outreach Specialist Teresa Andrews.



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Education/Outreach Specialist ... Teresa Andrews  
Scientific Editor ..... Suzette Smiley-Jewell

## Calendar

**Monday, March 2, 2015, 4:00 – 5:00 p.m., CHE, Old Davis Road, Davis** "California AgrAbility Project: History and new opportunities." **Fadi Fathallah, Ph.D.**, UC Davis Biological and Agricultural Engineering

**Tuesday, March 17, Noon to 1 p.m., UCDMC, 1130 K Street, Suite LL22, Conference Room B, Sacramento** "Improving the health of agricultural workers and their families in California: Current status and policy recommendations," **Marc Schenker, M.D., MPH**, Director of WCAHS and the Center for Occupational & Environmental Health

**Monday, April 6, 4:00 – 5:00 p.m., CHE, Old Davis Road, Davis** "Demographic, employment, and health characteristics of California farm workers: Recent findings from the National Agricultural Workers Survey." **Daniel Carroll**, Office of Policy Development and Research, Department of Labor

**Monday, May 4, 4:00 – 5:00 p.m., CHE, Old Davis Road, Davis** "Are pesticides making you fat?" **Michele Andrea La Merrill, Ph.D., MPH**, UC Davis Environmental Toxicology

**Monday, June 1, 4:00 – 5:00 p.m., CHE, Old Davis Road, Davis** "Have agricultural teachers been sufficiently trained, and are they training their students in ag safety & health topics?"

**Ben Swan**, Agricultural Education & Communication, California Polytechnic State University

## Join the AgHealth e-mail listserver

The Western Center for Agricultural Health and Safety's AgHealth e-mail discussion group is open to anyone interested in agricultural health and safety. We welcome and encourage participation by posting comments or questions about agricultural health and safety. Subscribe at the WCAHS homepage: <http://agcenter.ucdavis.edu>, click on "AgHealth email List."