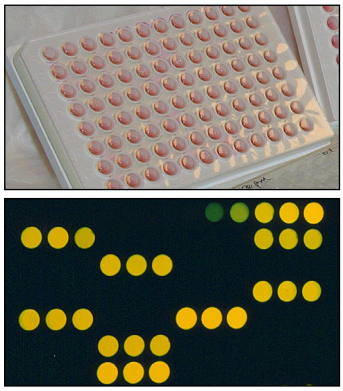
Superfund Research Program

The Superfund Research Program (SRP) supports practical research that creates benefits, such as lower environmental cleanup costs and reduced risk of exposure to hazardous substances, to improve human health. SRP funds colleges, universities, and small businesses, including the University of California, Davis Superfund Research Center (UC Davis SRC), to advance this work across the nation.

Research Highlights

Powerful new tools for detecting chemical contaminants



In a CALUX assay, wells that contain dioxins light up with a green color, and the color gains intensity with increasing amounts of dioxins. (Photo courtesy of UC Davis SRC)

UC Davis SRC researchers are blazing new trails by developing highly sensitive, specific, cost-effective, and portable methods to detect contaminants in biological samples and the environment. Michael Denison, Ph.D., developed the Chemical-Activated Luciferase Gene Expression (CALUX) assay for large-scale testing of dioxin-like compounds.[1] The CALUX assay is widely used for contaminant testing, such as monitoring industrial wastewaters.[2] Dioxin-like compounds are found in air, water, foods, and soils, and exposure can lead to skin disease, cancer, and developmental problems.[3]

Using a different approach, Bruce Hammock, Ph.D., and Shirley Gee discovered that proteins called antibodies can be used as tools to identify pesticides and dioxins in a highly specific manner. These antibodies allowed them to develop new cost-effective assays that rapidly detect a variety of contaminants in very large numbers of biological and environmental samples at a low cost.[4,5,6] UC Davis SRC researchers also created a new portable device that detects flame retardants, and results can be read using a smart phone camera.[7] The device allows researchers to test samples outside of the lab.

Education through an entrepreneurship academy

UC Davis SRC sponsors an annual entrepreneurship academy for commercializing science and engineering innovations. The intensive three-day program acts as a springboard to move research out of the lab, by educating students and researchers about potential business opportunities. It also teaches them how to communicate ideas and research results effectively. Venture capitalists, entrepreneurs, university faculty, and industry executives serve as mentors, providing participants with knowledge and networks to commercialize their research. UC Davis SRC also encourages trainees from other SRCs around the country to participate in the academy and provides travel funds to promote this interdisciplinary opportunity. Through the academy, UC Davis SRC shares its expertise in putting science to work to solve problems.

Students learn about bringing research to market by participating in an activity at the entrepreneurship academy. (Photo courtesy of UC Davis SRC)

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UC Davis SRC seeks to understand how hazardous substances cause disease, and how to clean up those substances in the environment. They are also developing innovative sensors and portable devices for measuring contaminants in biological samples and the environment that are highly innovative, rapid, sensitive, and cost-effective.

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Bioremediation provides solution to groundwater contamination

Kate Scow, Ph.D., and her team developed a new bioremediation approach using bacteria to break down and treat methyl tertiary-butyl ether (MTBE) in wastewater at water treatment plants.[8] Bioremediation is a treatment that uses naturally occurring organisms to break down hazardous substances into less toxic or nontoxic substances. MTBE is used as a fuel additive. Its use has declined in the U.S. in recent years. MTBE is linked to cancer and neurological effects when inhaled or ingested.[9] This new bioremediation technology successfully lowered MTBE levels at a very rapid rate when it was used to treat groundwater in North Hollywood, California aquifers.[8]

The importance of studying hazardous waste sites

Hazardous waste sites contain complex chemical mixtures that can be difficult to study. UC Davis SRC is developing rapid and inexpensive ways to identify those mixtures using innovative detection systems.

Research overview

- Assessing effects of environmental hazards on reproductive health. (Bill Lasley, Ph.D., bllasley@ucdavis.edu)
- Developing cost-effective systems to detect hazardous chemicals. (Michael Denison, Ph.D., msdenison@ucdavis.edu)
- Using nanomaterials to develop sensors to detect hazardous substances. (Ian Kennedy, Ph.D., imkennedy@ucdavis.edu)
- Developing field-portable detectors for human and environmental monitoring. (Shirley Gee, sjgee@ucdavis.edu)
- Identifying health effects of nanoparticles in the environment. (Ian Kennedy, Ph.D., imkennedy@ucdavis.edu)
- Predicting movement of contaminants in groundwater systems. (Kate Scow, Ph.D., kmscow@ucdavis.edu)
- Developing biological indicators to assess how the Superfund chemical naphthalene contributes to lung injury. (Alan Buckpitt, Ph.D., arbuckpitt@ucdavis.edu)

Sharing results

UC Davis SRC shares research results to improve understanding of how Superfund chemicals harm human health, and how to reduce exposures to those chemicals, to help government officials and the public make informed decisions about reducing risk. (Candace Bever, Ph.D., crspier@ucdavis.edu)

Other contributions to advance science

- The UC Davis SRC research support facility provides vital access to expertise, research resources, and state-of-the-art instrumentation for its research projects. (Bruce Hammock, Ph.D., bdhammock@ucdavis.edu; Dietmar Kueltz, Ph.D., dkueltz@ucdavis.edu)
- The UC Davis SRC integrated, multidisciplinary training experience provides early-career scientists access to teams of diverse professionals, and encourages innovation to develop solution-oriented approaches to complex environmental health problems. (Pamela Lein, Ph.D., pjlein@ucdavis.edu)

NIEHS Grant Number:

P42ES004699

Grant Period: 1987-2015

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Legislative Authority:

Section 311(a) of the Superfund Amendments and Reauthorization Act (SARA) of 1986

For more information on the National Institute of Environmental Health Sciences, visit **www.niehs.nih.gov**.

For more information on the Superfund Research Program, visit **www.niehs.nih.gov/srp**.

For more information on the University of California, Davis Superfund Research Center, visit **www.superfund.ucdavis.edu**.

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