New Laboratory Combines Cell Biology, Engineering

Why do farmers develop arthritis of the hip? Why are meat processors at risk for injuring their tendons?

You might not think of these questions as the kind an engineer would ask, but for some engineering faculty and students at UC Berkeley, they are of fundamental interest. The students and faculty are in bioengineering—one of the fastest growing programs on the Berkeley campus. Bioengineering brings scientists and engineers together to improve our understanding of human health and to develop new techniques for detecting and treating disease.

This semester, 28 bioengineering students have been learning how to address questions like these in a new laboratory course that has introduced them to cell biology with an engineering twist.

The Cell Biology Laboratory for Engineers—taught by COEH faculty members David Rempel and Karen King with Staff Research Associate Terry Johnson at UC Berkeley’s Center for Tissue Bioengineering—is one of the few in the country where engineering undergraduates and first year graduate students can learn cell biology techniques with a focus on tissue engineering.

“For example, the final project for the course is to design a plug of cartilage that might be inserted into a joint to replace damaged cartilage for someone who has severe arthritis,” Rempel said. “The students have to design cartilage plugs, determine what the cell concentrations should be, grow the plugs, and evaluate them for their mechanical as well as biological characteristics.”

The course introduces students to the biomechanical research that Rempel and King are conducting to understand how injuries to cartilage and tendons occur at the molecular level and to learn how to rebuild and replace damaged tissues in the body.

Describing the students in the course as “very bright and highly motivated,” Rempel said, “Students with a strong engineering background and an interest in biology have a great opportunity right now to address many unanswered questions about injury and health, at a time when the answers are not so far off.”

Rempel is an associate professor in the Department of Medicine at UC San Francisco and the Department of Bioengineering at UC Berkeley. He directs COEH’s Ergonomics Program. King, assistant adjunct professor in the Department of Medicine at UC San Francisco, is a visiting Berkeley faculty member in Bioengineering.

Staff Research Associate Terry Johnson shows DNA that has been isolated from cultured cells to students and faculty: (left to right) James Moon, Professor Karen King, Melissa Matsumoto, Professor David Rempel, Dino DiCarlo.

Students Melissa Matsumoto and Dino DiCarlo in the Cell Biology Laboratory for Engineers at UC Berkeley’s Center for Tissue Bioengineering.
Planning for the Next Five Years

This month, COEH is welcoming a team from the National Institute for Occupational Safety and Health (NIOSH), the federal agency that provides support for training our students specializing in occupational health. The NIOSH team will review the quality of our residency training in Occupational and Environmental Medicine; graduate training in Occupational and Environmental Health Nursing, Industrial Hygiene, and Ergonomics; and our Continuing Education and Farm Safety Coordinator programs.

To assess our progress in fulfilling the goals we set three years ago and to begin setting priorities for the future, representatives of each of our programs will come together next month, with guests from government, industry, labor, and our COEH counterparts at UC Los Angeles and UC Irvine. I look forward to hearing a variety of perspectives about changing health needs and how we can best address them. We have invited Larry Fine, former director of NIOSH, to be our keynote speaker and to present his vision of the path that environmental and occupational health must take in the years ahead.

One of the areas we will address will certainly be biological and chemical terrorism. Following the September anthrax attacks, I established a committee to examine how COEH can best provide information to policy makers, drawing upon the knowledge of faculty members here and in Southern California. We hope to learn more about the needs of state and local officials at our January planning session.

More than two decades ago, the Legislature established COEH to help protect people from work-related health hazards. Since then, the state has successfully reduced physical and chemical hazards in the workplace, and we have moved from a predominantly industrial to a service economy. As the nature of work has changed, concern about social and behavioral problems in the occupational setting has grown. COEH has expanded its network of faculty experts to include those who study these problems, and we now must address how to move forward in both training and research.

A third new area that we are beginning to explore is distance learning—using the power of technology to bring UC’s educational resources to a wider outside audience. As the recent report of the Institute of Medicine documents, our nation needs more practitioners with high-level skills in occupational and environmental health. We are successfully educating a small number of experts, but our challenge is to increase the skills of those already in the field and to disseminate information more widely. Distance learning is one approach to this challenge. We hope to use our distance learning program on ergonomics for dental practitioners as a catalyst for further efforts (see story, page 4).

I look back at this fall with the deepest sadness and horror. We have entered a new era, and our planning must address the manifold new challenges we face as we continue to protect the public, develop new knowledge, and educate future leaders in occupational and environmental health. I thank our members, staff, students, alumni, and friends who are contributing to this mission and extend my wishes for a healthy and safe New Year.

John Balmes
Acting Director
China Trip Changes Student’s Focus on Energy and Health

A visit to China has changed the way UC Berkeley doctoral student Susan Fischer plans to study energy and health. Fischer, a student of COEH faculty member Catherine Koshland, professor of Environmental Health and Energy and Resources, won the C.C. Chen Fellowship last spring from the School of Public Health Chinese Scholars Program for her proposal to study how cleaner-burning household fuels could reduce health and environmental problems in China. The fellowship honors the life and work of Dr. Chen, who is renowned for developing a public health system that has brought health care to China’s rural population.

With support from the fellowship, Fischer took a 10-week trip to China, where, for the first five weeks, she studied Chinese at Sichuan Normal University on the outskirts of Chengdu, a city in Sichuan Province where Dr. Chen had done much of his work.

“It was perfect for me, because, in the mornings and the evenings, I could walk in the countryside and speak with the local people,” Fischer said. Gaining enough facility in Mandarin to have simple conversations, Fischer befriended her neighbors and absorbed as much as she could about the community’s culture and lifestyle—an experience that had a profound effect.

“Before my trip, I was thinking about my doctoral research in a top-down way,” Fischer said, “I wanted to do a grand assessment of the potential for bio-energy (energy derived from biological sources) to improve people’s health and the environment. But I became more and more interested in looking at things from the scale of a village, which allows me to ask entirely different questions. Instead of making a lot of gross assumptions—for example, about how much of China’s agricultural residue might be used for energy—I might actually go out in the fields and ask people how much is available, and I’d have to think about who is going to bring that waste from the fields and whether they will earn enough to buy cleaner fuel. A whole different set of questions becomes important—questions that involve the distribution of a new technology’s benefits rather than the aggregate amount of benefits. To me this scale is just more interesting, but until I went to China, there was no way to be involved, because I’d never seen a village!”

More than 600 million people in China’s rural households use solid fuels (e.g., corn stalks, wood, and low-grade coal) for cooking and heating and are, thus, exposed to an extremely high level of indoor pollution that endangers their health. Solid fuels also account for much of China’s greenhouse gas emissions, which contribute to global warming.

In her work at UC Berkeley before her trip to China, Fischer, a mechanical engineer, had assessed the potential health benefits and greenhouse gas emission reductions that might accrue from replacing solid fuels in rural areas with fuels derived from agricultural wastes. She learned more about clean energy technologies in China during the second half of her visit there, when she joined Kirk Smith, COEH associate director for International Studies, and other researchers for site visits.

Since her return, Fischer has found a hands-on way to study the impact of introducing an improved form of fuel in rural China. She has joined a team of researchers from the United Nations Development Program, Princeton University, and Oregon State University who are working with Chinese government officials, engineers, and academics in Jilin Province to convert corn stalks to an energy-rich gas that is being piped into village homes. Fischer is analyzing how the new gas affects indoor air quality and people’s exposure to carbon monoxide. She intends to measure indoor air pollution before and after the new fuel is introduced, with a focus on fine particulate matter as well as carbon monoxide. The data she gathers in rural Jilin will be the basis for her doctoral thesis.

An inexpensive gas stove sits atop an older biomass stove in a rural home. Fischer will study how the change to gas affects indoor air quality.
New Internet Course Targets Dental Workers

How do you reach busy dental practitioners to let them know how to prevent a potentially debilitating work hazard?

That’s the question researchers in the UC Ergonomics Program at UC Berkeley’s Richmond Field Station are answering for the California Division of Occupational Safety and Health (Cal/OSHA).

Headed by Robert Goldberg, associate clinical professor of Medicine at UC San Francisco and a newly affiliated COEH faculty member, the researchers are developing an interactive Internet course to address carpal tunnel syndrome (CTS) and other work-related musculoskeletal disorders (WMSDs). A painful disease of the wrist, CTS afflicts dentists, dental assistants, and dental hygienists at three times the rate that it does workers in other fields.

The two-hour multimedia course consists of eight 15-minute segments that practitioners can access online at their convenience. It introduces CTS and the other WMSDs, describes the risk factors, and provides prevention and treatment strategies.

“We developed the course on the Internet so that we could reach dental professionals throughout California,” Goldberg said. “People can take as much or as little of the course as they wish at one sitting. They can pick and choose the lessons they want, and navigate back and forth for further reference.”

The new course will be available free of charge at www.me.berkeley.edu/ergo. Continuing education credit will be available for a fee. “Anybody with a computer who can get online to the Internet and click on either the Cal/OSHA Web site or ours will be able to access the course,” Goldberg said.

Using the dental ergonomics course as a model, Goldberg and his team plan to extend ergonomics training and education via the Internet to UC graduate students, engineers, and health and safety professionals in industry and government. “We are already converting elements of our graduate ergonomics curriculum, and we’re working on a WMSD medical management and prevention course for physicians and other medical practitioners,” Goldberg said.

Eventually, he hopes his team will offer health and safety education to industries across the country and will support distance learning for all of the COEH programs.

Goldberg brings unique experience to e-learning in ergonomics and other areas of occupational health and safety. A pioneer in Internet healthcare education, most recently as general manager for healthcare at DigitalThink, Inc., of San Francisco, he is also a leader in preventing workplace injury and illness. He is a fellow and past president of the American College of Occupational and Environmental Medicine and serves on its board of directors. He is the vice-chair, Occupational Medicine, of the American Board of Preventive Medicine. As a member of the California Industrial Medical Council in the mid-1990s, he led the effort to develop treatment guidelines for work-related injuries and illnesses.

The ErgoUC web site team includes COEH faculty member David Rempel, director of the Ergonomics Program, Ira Janowitz, the program’s chief ergonomist, web designer Helen Olds, and instructional designer Leslie Krongold. In addition to Cal/OSHA, the team is working with UC San Francisco’s School of Dentistry, the California Dental Association, and the California Dental Hygiene Association to develop and promote the ergonomics course for dental practitioners. The Zenith Insurance Company has contributed development support.
Health Concerns at Assembly Plant Merit Further Study, Researchers Find

COEH faculty and students investigating concerns about possible respiratory hazards at New United Motor Manufacturing, Inc., (NUMMI) in Fremont, California, have recommended further research to probe reported health problems and action to help protect workers in the Body Weld areas of the truck and automobile assembly plant.

The researchers made their recommendation after finding that NUMMI Body Weld workers reported having respiratory and gastrointestinal problems more frequently than did Assembly workers and noted that they feel better when they are away from work on weekends and holidays.

Assembly workers at the plant have hardly any risk of potential exposure to chemical fumes or vapors; however, Body Weld workers are at risk of potential exposure to metal fumes, dusts, welding gases, and pyrolysis decomposition byproducts from coatings, fluxes, and oils, the researchers reported. Another group of workers in the Paint Shop areas is at risk of potential exposure to vapors from solvents, primers, clear coat and base coat paints, reducers, and thinners.

While Paint Shop workers did not report having respiratory problems more frequently than did Assembly workers, the researchers found that significantly more Paint Shop than Assembly workers had been diagnosed by a health care provider to have chronic obstructive pulmonary disease.

In their report to NUMMI management and the United Auto Workers Local Union 2244, which jointly supported the study, the researchers cautioned that their findings may not accurately reflect the effects of exposures in the Body Weld department, because the rate of participation was low, they weren’t able to follow the workers and their symptoms over time, and they lacked objective validation of the information that the workers provided.

Nonetheless, in response to the frequency of respiratory and gastrointestinal symptoms reported by Body Weld workers, the team recommended further research, with objective measures—for example, lung function tests—and direct intervention, such as improving ventilation in the Body Weld areas.

The NUMMI study brought together faculty and students in many disciplines at UC Berkeley, Davis, and San Francisco under the direction of COEH faculty member Katharine Hammond of Environmental Health Sciences at UC Berkeley, Robin Baker, director of COEH’s Labor Occupational Health Program (LOHP), and COEH Acting Director John Balmes, a pulmonary specialist at UC San Francisco.

Control of Musculoskeletal Disorders in the Workplace: Principles and Case Studies

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A major UC study of the issues involved in helping injured workers get back to work has recommended that the workers’ compensation community needs better information and education to overcome widespread finger pointing and pervasive distrust.

Research has shown that injured workers who return to suitable work heal faster and better than those who stay home to recover. Returning to work under medically appropriate conditions helps workers avoid significant financial losses as well. However, the workers’ compensation system can make it difficult for injured workers to return to work in a timely manner.

To learn what barriers impede injured workers from returning to work and how to overcome them, UC researchers, under contract to the California Commission on Health and Safety and Workers’ Compensation (CHSWC), probed the perspectives of injured workers, claims administrators, union representatives, management representatives, and health care providers. A 60-member advisory group reviewed these perspectives and provided further insights.

In its report to the CHSWC, the project team said it had hoped to find “some areas of common ground” and had planned to formulate “concrete recommendations to improve return-to-work outcomes for California workers. Instead, we found gridlock.”

“The stress in the system was too great to move forward with recommendations for regulatory reform, as we had hoped. Instead, our recommendations address ways to reduce the hostility,” said Project Coordinator Juliann Sum, an attorney and industrial hygienist with the Institute of Industrial Relations and COEH’s Labor Occupational Health Program (LOHP) at UC Berkeley.

“One theme that pervaded the (focus group) sessions,” the researchers reported, “was distrust of other persons’ and organizations’ motives. Participants felt that financial incentives drive the actions of others, as opposed to a concern for the long-term employability of injured workers.”

Some claims administrators and management representatives felt that injured workers lie about their symptoms in order to stay off work and receive more benefits and that their attorneys and physicians are motivated by the desire to improve their fees. Union representatives believed that employers want to avoid paying for temporary disability benefits while the worker is recovering and select physicians who will serve this aim. Injured workers, union representatives, and health care providers expressed concern that the system is unfair to injured workers and that employers prefer to get rid of injured workers rather than accommodate them. Many participants felt that, to be effective, physicians need to understand the workers’ compensation system in depth. They also cited the need for physicians to listen well and be responsive, but disagreed as to whom the physicians should work with or believe.

Recommendations

As a first step in tempering this pervasive adversity and distrust, the researchers recommended that the CHSWC develop educational materials to explain the roles and responsibilities of those who provide services to workers and employers, their training, how they are paid, and how they are regulated.

Concluding that “injured workers often face suspicion and negative stereotyping, which can hinder recovery,” the researchers recommended that the CHSWC develop methods and activities to promote respectful treatment of injured workers.

The researchers also recommended that the CHSWC develop “model practices,” drawing upon the “best practices” of physicians, employers, and claims administrators that had emerged from the study and meet further with selected members of the
workers’ compensation community to identify possible strategies for overcoming “system-wide problems that prevent injured workers from returning to long-term, sustained employment.”

Physician John Frank, formerly of UC Berkeley’s School of Public Health, headed the UC project team. COEH faculty member Julia Faucett, director of the Occupational and Environmental Health Nursing Program at UC San Francisco, and Laura Stock, associate director of LOHP, served as project consultants.

The complete report, “Return to Work in California: Listening to Stakeholders’ Voices,” is available at www.dir.ca.gov/chswc.

Research Project Honored for Tracking Children’s Health in Agricultural Salinas

The Center for Health Assessment of Mothers and Children of Salinas (CHAMACOS) project—a pioneering partnership among researchers at UC Berkeley’s School of Public Health, health organizations in the Salinas Valley, and the Monterey County Health Department—was honored at UC Berkeley’s second annual University/Community Partners Recognition celebration.

The CHAMACOS (“small children” in Spanish) project is the first research study in the nation to track the relationship between the environment in an agricultural community and children’s health, starting with pregnant mothers and following their children into early childhood. Many of the 550 women and children participating in this five-year study are from farmworker families. Funded by the U.S. Environmental Protection Agency and the National Institute of Environmental Health Sciences, the project is examining possible risk factors for delayed development and respiratory symptoms in children with a focus on pesticides and allergens.

“Because of the region’s year-round agricultural production, the population in the area is more stable, providing the researchers an opportunity to work with a low income, underserved population and follow the mothers and their children over several years,” said CHAMACOS Associate Director Asa Bradman.

Another unique aspect of the project is the inclusion of diverse community representatives. “We felt it was important to ensure that our Community Advisory Board represented a cross-section of the community, which includes the county health officer, agricultural commissioner, a member of the county board of supervisors, farmworkers, advocates, the agricultural industry, and physicians who provide us with valuable insight about the community and the best ways to conduct the research,” said CHAMACOS Executive Director Brenda Eskenazi. “Our research findings and our ability to translate these findings depend on developing relationships and trust with the participants, community leaders, and residents.” A COEH faculty member, Eskenazi heads the Center for Children’s Environmental Health Research at UC Berkeley, where she is professor of maternal and child health and epidemiology.

The CHAMACOS project has also brought UC Berkeley resources the Salinas area. “We have been able to work closely with School of Public Health researchers to accomplish a number of goals, including bringing high quality asthma training to local physicians,” said Maximiliano Cuevas, CEO of Clinica de Salud del Valle de Salinas and one of the community partners involved in the research. “We also want to develop environmental health education programs for Monterey County that can serve as a model for California.” Other organizations involved in CHAMACOS include the South County Outreach Group and the Natividad Medical Center.
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