



Tracking the Causes of a Mysterious Disease

The School of Public Health at Berkeley has received \$4.5 million from the National Institutes of Health to expand its study of childhood leukemia—the most inclusive environmental analysis of this mysterious disease ever undertaken.

The large grant will more than double the size of the study from 150 to 400 children and from the Bay Area to all of Central California, making it possible for the first time to evaluate this fatal blood cancer's many potential causes—pollution, diet, genes, infections and even electric/magnetic fields.

In 90 percent of cases, the cause of leukemia in children remains unknown.

"It's unusual to know so little about the cause of a disease," said COEH faculty member Patricia Buffler, chief investigator for the study and former dean of the School of Public Health. "But childhood leukemia is still relatively rare, and you need a large study population to detect low-level associations."

The issue of chemical pollution is a powerful one for communities like Woburn, Massachusetts, where a polluted water supply was believed to have given several children leukemia. This true-life story is depicted in the current movie, "A Civil Action," starring John Travolta.

Eight families whose children were sick sued the corporations they thought responsible and won their case. But there was no proof that the chemicals had caused the disease, said Buffler, who was involved in the Woburn case as an epidemiologist.

"The people of Woburn won eventually; yet we could not answer

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Rempel's Ergonomics Team Refines Workstation for International Space Station

For the past few months, COEH faculty member David Rempel and his ergonomics team have worked against the clock to complete their part of the international space station project scheduled for launch October, 2002. Their task—to design a life sciences "glove box," where astronauts aboard the space station can comfortably perform ongoing biological experiments, from fertilizing eggs to neurological experiments measuring brain function in rats.

Rempel's lab had just three months to complete the project with the participation of NASA and sponsored by the Japanese Space Agency (NASDA), the agency responsible for the life sciences module of the space station.

"To meet the launch date, we had to do this project in very short order," says Rempel, who holds joint appointments in medicine at UCSF and bioengineering at Berkeley, and heads up the COEH Ergonomics Lab at Berkeley's Richmond Field Station.

Astronauts aboard the space station will work in the glove box for six to eight hours at a stretch, performing hand-intensive tasks. This precision work is done with arms extended deep inside the box and bodies floating behind them in space's zero-gravity environment. To stabilize themselves in



Astronaut Heidi Piper was among eight NASA astronauts who performed simulations in the ergonomics laboratory of David Rempel (bkgd) to test a new glove box designed to reduce shoulder muscle load while working on the international space station.

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Cooking Fuels Linked to TB Risk in India

A study examining the relationship between home cooking fuels and the prevalence of active tuberculosis (TB) in India has concluded that people in households that use biomass (wood or dung) for cooking are more than twice as likely to have active TB than people in households that use cleaner fuels.

The study, conducted by Vinod Mishra and Robert Retherford of the Program on Population, East-West Center, Honolulu, in collaboration with COEH faculty member Kirk Smith of Berkeley's School of Public Health, strongly suggests that the use of biomass fuels for cooking substantially increases the risk of tuberculosis in India.

The researchers' analysis, to be published this month in the *International Journal of Infectious Disease*, provides the first evidence that improving the environment could affect TB, which is a major health problem in India. The findings also have implications for mitigating the AIDS epidemic, according to Smith.

Tuberculosis accounts for nearly five percent of the national burden of disease in India, higher than any other world region. It is estimated that more than half of India's adult population is infected with the TB bacterium. Of those infected, typically five to ten percent become ill with active TB, and approximately 500,000 die each year from the disease.

Air pollution is commonly associated with motor vehicles and industry. In developing countries, however, air pollution tends to be highest indoors, due to the fuels used for cooking



Air sampling in India has found higher pollution inside homes than outdoors due to the fuels used for cooking and heating.

and heating. Smoke from biomass fuels contains noxious elements such as particles that can enter the lungs, carbon monoxide, nitrogen oxides, and benzo[a]pyrene, a carcinogen. About three-quarters of all Indian households use unprocessed biomass as their primary cooking fuel. Cooking stoves in most households are simple, often just a U-shaped mud pit or three pieces of

reported rather than doctor-reported TB, he explains. With funding from the Fogarty International Center of the National Institutes of Health, he and his colleagues are planning two more studies for the year 2000 to confirm the relationship between cooking smoke and TB based on clinically-confirmed cases.

If further research demonstrates the relationship between air pollution and TB, Smith says, one of the public policy implications is for government to make cleaner fuels available to people who can't afford to make the switch themselves.

Since TB is also the chief outcome of HIV/AIDS in Asia, and both are on the rise, another intriguing question arises. "We must ask," says Smith, "If both a poor environment and HIV/AIDS are risk factors for contracting TB, then can the overall impact of the AIDS epidemic be reduced by improving air quality? Perhaps minimizing suppression of the immune system

How Might Smoke from Cooking Increase the Risk of TB?

No one yet knows how smoke from cooking increases the risk of TB, although wood smoke has been shown to make laboratory animals less able to resist respiratory diseases. A hint at the mechanism in humans may be found in research done on cigarette smoke, according to Mishra *et al.* Cigarettes are also a form of biomass. Smoking cigarettes has been shown to increase the risk of TB, and tobacco smoke is known to depress the response of the immune system, leaving the body vulnerable to infection. To the extent that exposure to cooking smoke also suppresses the immune system, it may lead to infection or to increased risk of active TB in people infected with the tuberculosis bacterium.

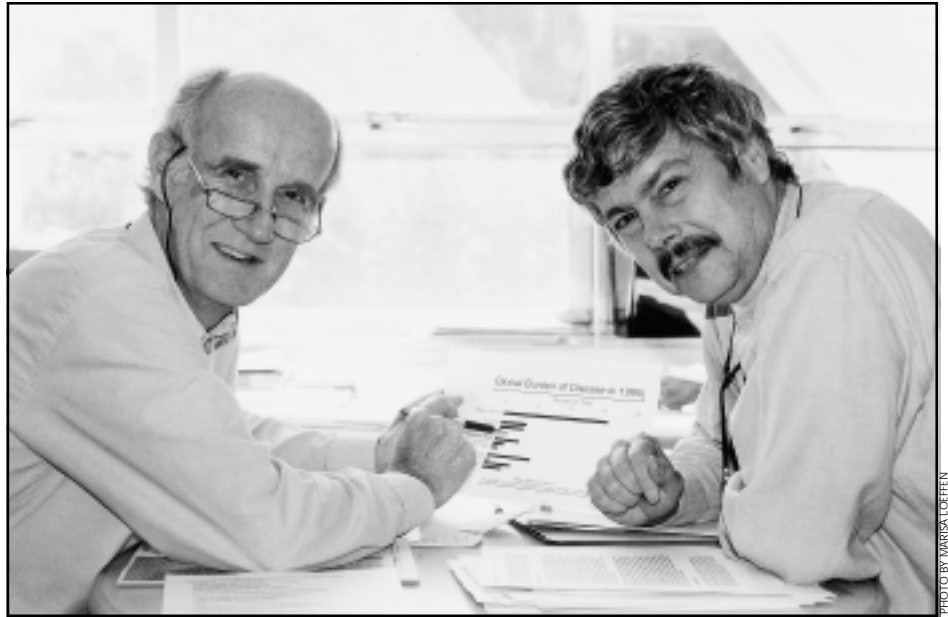
See **TB**, next page

McMichael: Sustaining Human Health on a Polluted Planet

Prominent environmental epidemiologist and author Anthony McMichael has been visiting the UC Berkeley campus to work with colleagues and students who share his concern for developing an ecological perspective on human health and disease.

McMichael is professor and head of the Epidemiology Unit at the London School of Hygiene and Tropical Medicine, recognized as the premier institution in the world addressing health issues in developing countries. He has been collaborating with COEH faculty member Kirk Smith of Berkeley's School of Public Health, with whom he is writing a chapter on environmental health for a textbook on international health to be published next year. The textbook will explore "larger frame" questions, such as how social and environmental change, energy use, and economic activity affect human health.

"We're entering a new world," McMichael said. "It has become clear, in the last quarter of a century, that the scale of environmental impact due to human numbers and patterns of economic activity has become so great that we're not just polluting local environments, we're actually starting to change some of the world's great biophysical systems, such as the climate system and the stratospheric ozone layer. We're starting to change the fertility of productive land around the world. We're depleting many of the world's ocean fisheries. We're emptying a lot of the underground water and aquifers. These are all huge changes that we are now causing in the world's environment on a quite new and unfamiliar scale, and it



Anthony McMichael (left), professor and head of the Epidemiology Unit at the London School of Hygiene and Tropical Medicine collaborates with UC Berkeley's School of Public Health professor Kirk Smith on issues concerning environmental health.

means that there are serious questions arising with respect to the sustainability of human health. If we go on weakening the life support structures, we can't expect to sustain good human health indefinitely. As we go through this next century, we've got to ask a set of additional questions that are larger than the ones we have traditionally asked in environmental health."

McMichael and Smith are both committed to finding new ways to understand environmental change and to improve human health. McMichael has played a leading role internationally in examining the health effects of global climate change. Smith is best known for his work on air pollution

and energy use. Since energy use patterns and carbon dioxide emissions are major determinants of climatic changes, the two scientists have a shared interest in thinking about how best to assess this problem and how to address it effectively in the public arena.

They co-authored an editorial in the January issue of *Epidemiology* in which they urged researchers to broaden their approach to studying the impact of air pollution on public health, arguing, for example, that much more needs to be known about the hazards of indoor air pollution. They are also collaborating on a study to evaluate the magnitude of health burdens attributable to air pollution in London. ■

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by reducing air pollution could prevent AIDS-associated TB. That's pretty revolutionary, since AIDS-associated TB and environmental issues are generally considered to be separate from one another."

"I've done other analyses showing that, from a health standpoint, it's quite

cost-effective, compared to other investments in improved health, to reduce exposures to biomass fuels, because of the big burden of disease they cause," he says. "This is a classic public health situation. It's true that, when everybody's rich, they won't need to use dirty fuel, just as they won't

drink dirty water. The history of public health has been to identify those things that can be done before everybody gets rich and to provide levers that can achieve a big improvement in health, without waiting. Clean water, vaccinations, vitamin supplements, and clean fuels are those kinds of levers." ■

New Computer Keyboard Design Reduces Hand Pain

Researchers have found that a new computer keyboard design can decrease hand paresthesia—numbness, tingling, or burning in the hand—experienced by frequent computer users.

“This is the first randomized clinical study to demonstrate that keyboard design can reduce pain in computer users who have hand discomfort similar to symptoms of carpal tunnel syndrome,” said study director and COEH faculty member David Rempel. “The study showed that a significant reduction in symptoms is possible with a simple intervention—modifying the springs underneath each key that change the force and feel of the key switches.”

Study findings showed that at six weeks there was no significant difference in pain levels between keyboard groups. However, after 12 weeks participants who used the keyboard with modified keys experienced a significantly greater reduction in hand pain compared with participants using the more traditional keyboard.

Rempel and research colleagues selected 20 participants—full-time employees of LLNL in Livermore, California—who reported to the occupational medicine clinic for hand or wrist symptoms within six months of the start of the study. Patients were eligible to participate in the study if they (1) met the criteria for possible carpal tunnel syndrome; (2) used a computer keyboard for at least two hours per day or ten hours per week; (3) had been employed in their current job for at least three months; and (4) had no prior surgery of the hand or wrist.

Researchers paired participants according to both the amount of time spent at a computer per week and which hand experienced pain. Of the pair, one was assigned to keyboard A, with the new keyswitch design, while the other was assigned to keyboard B, with conventional keys. Both keyboards were similar in external appearance. The difference, said Rempel, was the force displacement characteristics of the springs underneath the redesigned

keys, resulting in a difference in the amount of force needed to depress the computer keys. Participants used the assigned keyboards for 12 weeks.

Prior to the intervention, participants provided their medical history and underwent physical examinations, and nerve conduction tests, which reveal how well the nerve is functioning by measuring how fast an electrical signal travels through the nerve. Additional health measures collected at six weeks and 12 weeks included self-reported symptoms, hand function tests, and physical examinations. With the hand function test, participants were asked to flex their wrist to maximum, maintain the position for 60 seconds, and report when, if at all, symptoms of numbness and/or tingling occurred in the fingers. This test is also called the Phalen test time and is considered an indication of the severity of carpal tunnel syndrome, said Rempel. Researchers found an improvement in the Phalen test but no change in the nerve conduction test before and after the use of both keyboards.

Given these findings Rempel and research colleagues recommend the following:

- Health care providers who care for computer users with hand discomfort may recommend a three-month trial of the keyboard used in the study (Protouch keyboard, Key Tronic Corp.)
- Computer users with hand pain should reduce time on the keyboard



Modifying the springs underneath the keys of a keyboard, which changes the “feel” of the keys, decreased numbness, tingling, or burning in the hands.

and take adequate breaks from the computer

- Computer users should be knowledgeable of appropriate working postures and work breaks
- Keyboards with new designs do not replace medical interventions. Computer users and health care professionals should not ignore traditional treatments for hand pain and carpal tunnel syndrome

Results of the study were reported in the February 1999 issue of the *Journal of Occupational and Environmental Medicine*.

Co-authors of the study are Pat Titteranonda, graduate of the ergonomics program and now a post doctoral fellow at LLNL, Stephen Burastero, occupational medicine physician at LLNL, Mark Hudes, senior biostatistician at UC Berkeley, Yeun So, associate professor of neurology at Stanford University and clinic director of neurology at UCSF Stanford Health Care at Stanford. ■

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this floating position, astronauts in the past forced their shoulders into a corner or jammed their arms into the glove box ports (openings), trying to remain still enough to work. They would hold these painful positions for hours at a time.

"If the glove box isn't well designed, the astronauts exert more muscle activity to perform the same task," says Rempel. "This becomes a big deal when you're working in one position for long stretches of time. It makes the design of the box critical to preventing nerve problems and muscle pain in the astronauts."

Rempel's team departed from the approach of previous glove boxes with a decision to design a glove box that would fit an astronaut's so-called "neutral," at-rest body posture, afloat in a zero-gravity environment.

"The biomechanics in a zero-gravity setting are very different than on earth," says Rempel. "On earth, when we think about designing workstations, the role of gravity has a significant effect on the tissues and muscles in the limbs and torso. In space, there's no contribution at all from gravity; instead, you have to worry about the reaction forces, that is, the forces applied by the hand to tools, by the arms to the glove box ring, by the feet to the floor, in addition to the contact forces of the body on other structures in the space station."

Using a computer modeling program, researchers simulated three-dimensional astronaut-mannequins based on two extreme body types—from a diminutive Japanese female to a hulking American male. They positioned the mannequins floating in neutral body position, then simulated their interactions with a computer mock-up of the glove box.

The design solutions began taking shape as researchers adjusted and readjusted the box's elements to suit the mannequins' neutral body posture—modifying the size and location of the glove ports, the size and slope of the window the mannequins looked through, the distance to the back wall, as well as the locations of the tasks performed. Each element was modified

until a final solution was identified that would work for both body type extremes and everyone in between.

"This was the trickiest part of the project," says Rempel. "The glove box has to be one fixed design that works for anyone using it. It has to be large enough to accommodate all the equipment you'd find in a cell biology lab, yet small enough so that a small person can reach the sides, back, and top."

A titanium suspension device equipped with a "diaper" that wraps around the waist and legs suspends the astronauts near their center of gravity during lab testing. Created by engineer Ron Tal, it provides astronauts the freedom to rotate in order to mimic a zero-gravity environment.

In March, eight astronauts (four retired, four currently in the space program) visited the Richmond Field Station to test the glove box and suspension system. Each spent a day in the Ergonomics Lab, performing simulated dissections and tasks involving reach and vision, while researchers adjusted the box's parameters. Light-emitting diodes attached to the astronauts' arms recorded postures of the shoulder, head, and hips to help assess the effects of the box's parameter changes.

A mock-up will be built, then tested in June at the Johnson Space Center on the aircraft used to film the weightless scenes in *Apollo 13*. The plane maneuvers in long parabolic loops that rise and fall quickly enough to mimic zero-gravity. Passengers aboard experience weightless moments for 20 seconds at a time. After the on-board tests are complete, the glove box will be ready for production in Japan, a complex manufacturing process expected to take up to a year.

"This is a one-of-a-kind product," says Rempel. "We have to get it right the first time because this is the design that will last in the space station for the next 10 to 20 years." ■

—Excerpted from article
by Nancy Bronstein

Courtesy of UCB College of Engineering

Spear and Colleagues to Assess Workplace Training Needs



PHOTO © PEG SKORINSKY

COEH Director Robert Spear has been named by the Institute of Medicine to serve on its Committee to Assess Occupational Health and Safety Training Needs.

The committee, established at the behest of the National Institute for Occupational Safety and Health (NIOSH), will gather and analyze information to help NIOSH and other policy makers understand the changing nature of health care delivery in the United States and address new training needs. Spear's special focus in this effort is industrial hygiene.

Also on the committee are former chair of the COEH Advisory Committee, Linda Clever, physician and chair of the Department of Occupational Health at the California Pacific Medical Center; and current chair of the COEH Advisory Committee, M. Donald Whorton, a physician in private practice. James Merchant, head of the Department of Preventative Medicine and Environmental Health at the University of Iowa, chairs the committee. ■

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their questions," said Buffler. She said that Woburn and hundreds of other cases like it have motivated her to undertake this very large study.

"All too often, you can't ascertain causes by investigating a few clustered cases. You have to study an entire population. That is what we are doing."

Buffler said that every child diagnosed with leukemia in one of nine hospitals that together serve 35 California counties will be enrolled in the study. Each child will be matched with an age mate born in California at nearly the same time. He or she also will be matched with a friend so that researchers can compare the three subjects—one with leukemia and two without—on the basis of geographical region and socioeconomic status.

In every case, the child's environment and that of his or her parents will be evaluated in excruciating detail.

Researchers will visit the home, collect information on diet, including the mother's prenatal diet, take dust swipes from the child's bedroom and install a meter to measure electric and magnetic fields. They will identify chemicals used around the house and take a medical history of infections. They also will evaluate the parents' workplaces for chemicals and analyze the child's and the mother's blood for genetic susceptibility and immune function.

When the codes are broken in the spring of the year 2000, "we will be able to say that we see, or we don't see, an association with environmental causes," said Buffler.

"Hopefully, we will be able to provide either reassurance or advice in terms of how to take protective action."

The first results next year will reflect the findings of the 150 children currently in the study; findings on the full 400 will be available in the year 2004, Buffler said.

She and her team will evaluate five different theories concerning the causes of leukemia: (1) that a deficiency in certain micronutrients such as folic acid increases the risk; (2) that the age at which children first contract some common infectious diseases affects the later appearance of leukemia; (3) that inborn genetic susceptibility is a contributing cause; (4) that household or workplace chemicals lead to the blood cancer; and (5) that residential exposure to electric and magnetic fields increases the risk of developing the disease.



PHOTO COURTESY OF DR. CAROLYN HOPPE

Three-year-old Jacob Sattler, a subject in the leukemia study, was diagnosed when he was only two months old.

Hospitals that diagnose virtually all leukemia cases in the 35 counties will

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It Takes a Coalition to Learn What Causes Childhood Leukemia

Four or five children out of every 100,000 in California are struck by childhood leukemia each year. About three-quarters of these children can be successfully treated, but they face a greater risk of cancer later in their lives. The key to preventing this deadly disease is to understand what causes it, but surprisingly little is known.

COEH faculty member Patricia Buffler and colleagues have formed a broad coalition of academic and clinical researchers, hospitals, and public health agencies to undertake a massive study of the suspected causes, both biological and environmental.

The new study expands upon Buffler's earlier research supported by Berkeley's Superfund Research Program directed by COEH faculty member Martyn Smith, who is collaborating with Buffler on the expanded study. Other members of the research team are COEH faculty member Katharine Hammond of Berkeley's School of Public Health, Gladys Block and Steve Selvin of the School of Public Health, Peggy Reynolds of the California Department of Health Services, John Wiencke of UCSF, and James Feusner and Bertram Lubin of Children's Hospital, Oakland.

Does Natural Asbestos Increase Cancer Rate?

Do communities in California with large asbestos deposits have a higher rate of mesothelioma—a rare, untreatable cancer that affects the linings of the lungs and abdominal cavity?

With funding from the National Cancer Institute, a multidisciplinary team at UC Davis is taking the first steps to answer this question.

Marc Schenker, COEH program director at Davis, Howard Day, professor of geology, and their colleagues will analyze mesothelioma rates by county, determine the location and extent of asbestiform rock, and assess people's potential exposure to asbestos deposits due to activities that break or crush asbestos-containing rock, such as mining, real-estate development, road-building, and farming.

The multidisciplinary research team will use this information to analyze the association of past environmental asbestos exposure and mesothelioma rates. If the study finds a consistent association, the researchers plan to conduct a case-control study to test the hypothesis that mesothelioma in California is independently associated

with exposure to environmental asbestos.

Asbestos is a natural part of the California environment—more than half the counties in the state contain significant quantities of asbestos-bearing rock.

Public concern about exposure to asbestos in areas of new housing and population growth has attracted media attention in recent years. A survey

conducted by the *Sacramento Bee* found environmental asbestos contamination near homes in El Dorado County.

Few guidelines exist for developing asbestos-containing areas. The Davis study of the potential hazards of naturally occurring asbestos—the first study



At Davis, professor of geology Howard Day (left) and COEH program director Marc Schenker plan to study the potential hazards of naturally occurring asbestos—the first study of its kind in the nation.

of its kind in the nation—comes at a time when more and more people are moving into asbestos-containing areas.

"We hope to provide information that will help policy makers prevent exposures that can lead to a deadly disease," Schenker said. ■

Leukemia, cont. from previous page

be involved in the study. They include Children's Hospital in Oakland; Kaiser Hospitals in Oakland, San Francisco and Sacramento; UCSF Medical School Hospital; Stanford Packard Children's Hospital; UC Davis Medical School Hospital; Sutter Hospital in Sacramento; and Valley Children's Hospital in Fresno.

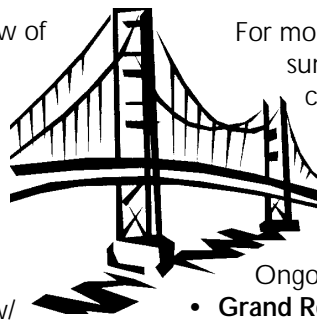
The addition of hospitals in California's Central Valley will increase the number of cases in which agricultural chemicals might play a role.

"We are going to find out as much as we can regarding the causes of leukemia in children," said Buffler. "This is a disease you want to prevent." ■

—By Patricia McBroom
Excerpted from the *Berkeleyan*

August 2-6, 1999 COEH Annual Occupational Safety & Health Institute Holiday Inn Bay Bridge, Emeryville, CA

- Comprehensive Review of Industrial Hygiene
- Occupational & Environmental Toxicology for the Health & Safety Professional
- Workers' Compensation: 1999 Overview/Update for Occupational Health & Safety Professionals
- The Occupational Health Nursing Role in Workers' Compensation
- Material Handling Analysis & Ergonomics Interventions
- Respiratory Protection: Overview/Update



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- **Agriculture Seminar Series** http://agcenter.ucdavis.edu/agcenter/announce/seminar_series.htm ■

New Journal to Address Environmental Medicine

Researchers here and abroad are about to launch a new *Journal of Environmental Medicine* as a forum for health professionals who want to explore the effects of exposure to hazardous physical, chemical and biological agents in the environment.

The new journal, to be published this summer by John Wylie and Sons,

will help meet the growing need to evaluate the health impacts of environmental toxicants more thoroughly from a medical perspective, according to Marc Schenker, COEH program director at UC Davis, and chair, Epidemiology and Preventive Medicine on that campus.

Schenker and Professor Jacques Descotes of the Poison Center and Department of Pharmacology, Medical Toxicology and Environmental Medicine, INSERM, Claude Bernard University, Lyon, France, are the founding editors of the journal. COEH faculty

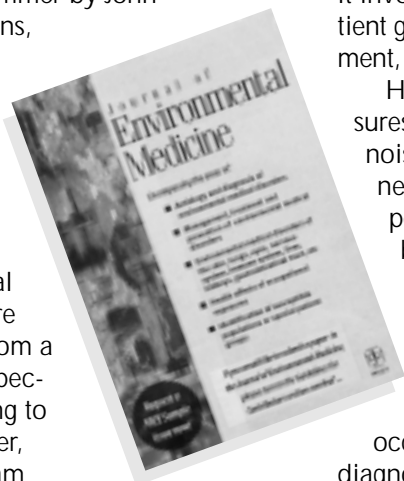
member Kirk Smith at UC Berkeley, serves on the editorial board.

Environmental Medicine is the area of medical practice devoted to understanding, assessing, managing, and preventing human health disorders related to hazardous exposures in the workplace, home, and outdoor environment. It involves identifying susceptible patient groups, clinical diagnosis and treatment, risk analysis, and regulatory issues.

Hazardous environmental exposures include physical factors such as noise, radioactivity and electromagnetic fields; chemical factors such as pesticides, heavy metals and asbestos; and biological agents such as mycobacteria, fungi and viruses.

The journal will include reviews, research, and case reports about all medical aspects of environmental and occupational disease, including diagnosis, therapy, preventive measures, epidemiology, occupational medicine, and clinical toxicology. It will also provide information about other resources, such as books, software, CD-Roms, and selected Internet sites. Each issue will include reports about recent meetings and announcements of forthcoming events. Letters to the editors discussing material published in the journal will be welcome.

For a review copy or for further information, please contact Schenker at the Department of Epidemiology and Preventive Medicine, School of Medicine, University of California, Davis, CA 95616-8638, or send e-mail to mbschenker@ucdavis.edu. ■



Center for Occupational and Environmental Health

Located on the Berkeley, San Francisco and Davis campuses of the University of California, COEH trains occupational and environmental health specialists in medicine, nursing, toxicology, epidemiology, policy, ergonomics and occupational hygiene. It also conducts research and facilitates exchange of information and experience among labor, industry, and the academic community to better serve the working population. In 1982, it was designated an Education and Research Center (ERC) of the National Institute for Occupational Safety and Health (NIOSH). The COEH Newsletter is published quarterly and made available at no charge.

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