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Environmental Health and Medicine

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ON YOUR BEHALF

A sample of legislation and advocacy activities SFMS/CMA provide for you

RETURNABLE FLU VACCINE AVAILABLE; IT'S NOT TOO LATE TO VACCINATE

The Centers for Disease Control & Prevention (CDC) have authorized Sanofi Pasteur to begin on Friday, January 6, selling its stockpile of flu vaccine to physicians and others. To encourage continued vaccination efforts, and to minimize financial risk to physicians, the vaccine is being sold with a return policy. Physicians will be able to return unused vaccine within 30 days for a credit. Flu vaccine is also available from some vaccine distributors, including FFF Enterprise (nonreturnable) and McKesson Corporation (returnable). Some physicians who have extra vaccine for sale have also contacted CMA. Contact Robin Flagg (415)882-5110 or rflagg@cmanet.org for more information.

CONGRESS FAILS TO PASS MEDICARE PAYMENT FREEZE BY JAN. 1; PHYSICIANS URGED TO SUBMIT CLAIMS FOR BILLED CHARGES UNTIL CONGRESS STOPS THE CUT

In mid-December, the U.S. House of Representatives passed a federal budget package that would have stopped the 4.4 percent Medicare cut and frozen physician payments at 2005 rates. However, the Senate passed an amended budget package that had to go back to the House for final approval. Unfortunately, by that time almost all members of the House had left Washington for the holidays and House Republican leaders declined to take action on the Medicare physician payment issue. Because Congress did not complete its work, the Centers for Medicare and Medicaid Services (CMS) were obligated by law to implement the scheduled 4.4 percent rate cut on January 1.

CMA and AMA are working vigorously to get Congress to pass the payment freeze that was agreed to in December. In the meantime, physicians should submit to Medicare claims for billed charges, rather than billing at 2005 or 2006 fee schedule rates. Physicians will be paid by NHIC, California's Medicare carrier, at the reduced 2006 rates until Congress returns and passes legislation reimplementing the higher 2005 payment levels.

NHIC will then make appropriate payment adjustments, including possible positive retroactive payments if authorized by the legislation. (It is yet to be determined how these retroactive payments would be disbursed.) Only physicians who submit claims for billed charges will be eligible for these retroactive payments. Physicians who bill at the lower 2006 fee schedule will not receive retroactive payment increases if indeed Congress returns physician payments to the higher 2005 levels.

Although the 2006 Medicare participation enrollment period is over, CMS has also indicated that it will allow physicians to change their participation status once Congress has taken action on the physician payment issue.

Contact: Elizabeth McNeil (415) 882-3376, emcneil@cmanet.org, for more information.

CLARIFICATION ON PHLEBOTOMY CERTIFICATION FOR MEDICAL ASSISTANTS

Effective April 9, all persons performing phlebotomy in California must be either licensed or certified in order to draw blood for laboratory testing. The law does, however, provide an exception for medical assistants working in physician offices under the supervision of a physician, registered nurse or other licensed healthcare provider.

If a medical assistant wants to perform phlebotomy outside a physician office or clinic, he or she must be a Certified

Continued on page 5

Phlebotomy Technician under regulations of the California Department of Health Services. There are three levels of certification for phlebotomists: Limited Phlebotomy Technician (skin punctures), Certified Phlebotomy Technician I (venipunctures and skin punctures), and Certified Phlebotomy Technician II (skin punctures, venipunctures, and arterial punctures).

Health care professionals—including physicians, registered nurses, licensed vocation nurses, and clinical laboratory scientists—do not need additional phlebotomy certification to perform skin, vein, or arterial punctures, as they are authorized to do so under their professional licenses. More details are available in CMA ON-CALL document #1605, "Medical Assistants."

SAVE THE DATE: EMR CONFERENCE IS MARCH 25 IN SAN FRANCISCO

CMA is cosponsoring the Healthcare Information and Management Systems Society's electronic medical records conference, "Physicians Adopting Computer Technology." The one-day program is March 25 at the San Francisco Airport Marriott. Attendees will receive step-by-step guidance on selecting and implementing electronic medical records (EMR). Presented by physicians who have been through the process, the conference will explore: choosing the best system for your practice size, budget, and specialty; converting successfully from paper to electronic records; avoiding common mistakes; helping colleagues and staff who aren't computer savvy; ensuring the system integrates well with hospitals, pharmacies, and other practices and avoiding legal problems and ensuring confidentiality. The conference also includes product exhibits and demonstrations of today's top EMR products.

Register by March 6 and receive $50 off the registration fee. CMA members pay $139, nonmembers $169. (After March 6, members pay $189, nonmembers $219.)

CHANGE IN CIVIL RIGHTS LAW BARS DISCRIMINATION BASED ON MARITAL STATUS JUST ONE OF DOZENS OF LAWS THAT WILL IMPACT PHYSICIANS

California anti-discrimination law has been updated to outlaw discrimination based on marital status. California's Business & Professions Code has for years prohibited discrimination on many grounds, including marital status, and provided that all invidious discrimination could result in a finding of unprofessional conduct.

The state's civil rights law, the Unruh Civil Rights Act, had previously barred discrimination based on sex, race, color, religion, ancestry, national origin, disability, sexual orientation, medical condition and other grounds, but it did not specifically include marital status. In 2005, the Unruh Civil Rights Act was amended by the Legislature to bar discrimination based on marital status.

The law requires physicians to treat all "similarly situated" patients equally. So, while a physician can choose not to perform a certain procedure at all, if that physician performs a procedure for married patients, he or she cannot deny the procedure to similarly situated patients who are unmarried. Physicians should ensure that they treat patients without regard to their sex, color, race, religion, ancestry, national origin, disability, medical condition, marital status, or sexual orientation and that differences in treatment are based on medically relevant circumstances.

This law is just one of dozens of new laws that will affect physicians in 2006 and beyond. For more information on new laws of interest to physicians, read CMA's annual "New Laws" article. Contact CMA's legal information line for more information at (415) 882-5144 or legalinfo@cmanet.org.

SFMS IS MOVING AT THE END OF JANUARY. OUR NEW ADDRESS IN THE PRESIDIO WILL BE:
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For further information please visit http://www.sfsu.edu/%7Ehrwww/jobsearch/112105.htm for the week of Nov. 21 & send res. w/ SS# & Job #300 to HR Dept, 1600 Holloway Ave, Room 252, SF, CA 94132-4252. Open until filled. EEO/ADA.

ATTENTION SAN FRANCISCO PHYSICIANS:

Your journal currently seeks your CREATIVITY. We want poetry, short anecdotal stories, photography, photographs of paintings, drawings, sculptures, or other original works of art for publication in *San Francisco Medicine.* Don't be shy. Submit your work and encourage other physicians to participate. We'd like to begin including original artwork in each issue. We are also looking for future cover art. Send to Edare Carroll, managing editor, at ecarroll@sfms.org or mail to *San Francisco Medicine, c/o* 1409 Sutter Street, San Francisco, CA 94109.

Gordon L. Fung, MD
President

President's Message

What Is the Mission of the San Francisco Medical Society?

As I prepare for the year 2006 as your elected president, I am deeply indebted to Alan Greenwald, MD, your immediate past president, for arranging a retreat for the leadership of the SFMS. The timeliness of the retreat was key as we, your leaders, have embarked on a course that will focus our energies on the mission of this medical society.

Over the last year, we have accomplished many things, including a very successful delegation to CMA's House of Delegates, where numerous resolutions were developed by SFMS delegates and brought to fruition at the House. We welcomed the biannual visit by the Hiroshima delegation from Japan as they performed their biannual evaluations on the survivors of the Hiroshima bombing. And I am pleased to report, albeit with mixed feelings, that we also sold the mansion at 1409 Sutter Street, the current location of the SFMS. As part of the sale, we disbanded our rentals and catering enterprise, which although successful at the outset was a victim of the 9/11 cutbacks and never really recovered to its initial glory. As we prepare to move to a new location in a few weeks, the retreat has been a wonderful opportunity to review the purpose of the SFMS and redirect our energies.

The retreat process can sometimes be mundane and tedious. But this one energized us and gave us a sense of purpose. It helped to focus the SFMS leadership and staff and gave us all a working blueprint for the next year—my year as president.

During the morning hours of the retreat, we learned something interesting—very few of us knew what the mission of the San Francisco Medical Society was. Thus, we spent a fair amount of time discussing the strengths and weaknesses of the organization; the issues of relevancy; and our current reputation among our membership, patients and nonmember physicians, as well as ourselves. We looked at our current mission statement and felt that it was no longer relevant to our current activities. A smaller task group at the retreat took on the job of wordsmithing a new mission statement so that it summarized the sentiments of the members present. It was further revised and then voted on unanimously.

I'm pleased to relay that the new mission statement of the SFMS is as follows: "The San Francisco Medical Society serves the needs of all San Francisco physicians and advances the health of our patients and community."

I believe this is a very action-oriented statement that more closely reflects the activities and proceedings of our organization. Numerous physicians volunteer their time and expertise at SFMS to address the needs of members and offer solutions to the challenges of working in the beautiful but expensive city of San Francisco. The liability insurance crisis that exists in other states is not such a problem in California due to our previous efforts with MICRA and the continued watchful surveillance of the CMA and the delegates as well as SFMS members on CMA's Council of Legislation and Board of Trustees. The SFMS delegation met with Assemblyman Leland Yee and our state legislators to defeat several issues and bills that would restrict in-office imaging to a single specialty group of physicians, impose onerous responsibilities on us to have on-site interpretation in every medical office, and require physicians to have required CME on use of antidepressants, cardiac risk factor management and warning signs of a myocardial infarction and stroke.

We also developed specific plans to address four major areas: membership, information technology, fellowship and wellness, and political advocacy.

As your president, I welcome your input and energy. I look forward to serving you in any way I can. It is coincidental but highly fortuitous that 2006 is the Chinese Year of the Dog. The dog is a giving and compassionate personality; offers kind words, support and advice to friends and family; and is a listener, always available to lend an ear or a shoulder to a friend in need. Dogs are incredibly attentive. Dogs are responsible, compassionate, reliable, honest, but sometimes anxious, overwhelming, and even nosy. So, with these characteristics as a framework for the coming year, I am truly excited about serving as your president of the new, improved and somewhat leaner SFMS.

By the time this article is in print, the holidays will have come and gone. Still, I wish members and their families a wonderful holiday season and hope you are looking forward to celebrating the New Year and the Year of the Dog. January 26, 2006, is Chinese New Year's Day.

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Mike Denney, MD, PhD
Editor

Editorial

Kant's Dove

In *Critique of Pure Reason*, the 18th century philosopher Emmanuel Kant argues that an a priori direct personal experience of oneself in intimate relationship with one's environment is a necessary foundation for clear understanding. He says that abandonment of the immediate world of the senses leads to hubris in which one is deceived by isolated reason and deprived of a solid or useful foundation of knowledge.

To emphasize his point, Kant uses the metaphor of a dove that wants to change its environment: "The light dove cleaving in free flight the thin air, whose resistance it feels, might imagine that its movements would be far more free and rapid in airless space." This misguided bird might alter its environment in an attempt to improve its own mobility, even survival, only sadly to discover that the very resistance of the air was what had provided the buoyancy for flight—and the well-meaning dove falls and crashes to the ground.

As in this issue of *San Francisco Medicine* we contemplate environmental medicine—the epidemiology of cancer, lead poisoning, chemicals and fertility, pollution and cardiology, biomonitoring of toxins and systems theory in environmental health—is it possible that we have something to learn from Kant's dove? Might we find guidance in the psychology of the relationship of *self* to *other*?

The predominant theme of our established body of psychology is what some describe as the fallacy of the isolated individual. Freud's theories of the id and ego, Adler's notion of individual psychology, indeed, almost the whole opus of psychoanalysis and psychotherapy were all focused upon the isolated, inner world of the patient. This led initially to the angst of existentialism, developed later into the "me" generation of the sixties and seventies, and culminated in the self-indulgent dynamics evidenced by the descriptive title of Christopher Lasch's book *The Culture of Narcissism*. Historian and ecologist Theodore Roszak has pointed out that of the thousands of psychological conditions listed in the medical diagnostic manuals only one, seasonal affective disorder, refers to a patient's relationship to the environment.

However, in his book *Ecopsychology*, Roszak, together with a diverse group of psychologists, educators, humanists and environmentalists, published a collection of essays that emphasize that the human psyche is an integral part of the web of nature and acknowledges that because we eat, breathe and interact, the definition of "self" does not end at our skin.

The psychologist James Hillman put it this way: "The 'bad' place I am 'in' may refer not only to a depressed mood or an anxious state of mind; it may refer to a sealed-up office tower where I work, a set-apart suburban subdivision where I sleep, the jammed freeway where I commute between the two." He might have added that the physical symptoms that we experience, indeed the cancer and heart disease from which we suffer, are also caused partly by the polluted and stressful environment in which we live.

Yes, there is a physiological component to these psychological dynamics of relationship of self to other. Neuroscientists Andrew Newberg, MD, and Eugene D'Aquili, MD, performing PET scans that detect radioactive tracers, have identified a small area in the posterior superior parietal lobe of the human brain that they call the OAA, orientation association area. The PET scans of this OAA show vibrant bursts of brilliant reds and yellows as the brain monitors the resting subject's place in relationship to the surrounding landscape, "to generate a cognition of the physical limits of the self . . . the distinction between the individual and everything else . . . to sort out the you from the infinite not-you that makes up the rest of the universe."

Newberg and D'Aquili performed these PET scans upon a group of Tibetan monks in meditation and a group of Franciscan nuns in prayer. The researchers noted the colors in the OAA area of the brain changed to more peaceful cool greens and blues when the monks reached a state of meditation in which they experienced a feeling of being "part of everyone and everything in existence," and when the nuns related "a closeness to God" and became "content with everything."

Perhaps these philosophical, psychological and physiological concepts offer us a way to learn from the error of Kant's dove. As we seek to change our environment, to create new technology with which to enhance life, we can take care that we do not destroy the very elements that nurture our survival. In that spirit, we can not only diagnose and treat patients who suffer from the effects of toxins and pollutants, but we can also prevent illness by protecting and preserving our natural habitat. As physicians heeding the critique of pure reason, we can soar in the free flight of intimate relationship with *other* so that we and our environment will not fall and crash to the ground as would Kant's misguided dove.

Letter to the Editor

Dear Editor,

On behalf of the Forensic Mental Health Association of California (FMHAC) I would like to thank you for focusing your recent journal (October 2005) on Medicine and the Law. The mission of FMHAC is to foster the provision of mental health services to mentally ill persons in the criminal justice system and to advance the profession of forensic mental health.

Untreated mental illness is a social and medical crisis. Budget compromises, lax mandatory civil treatment laws and political neglect have shifted the burden of this crisis onto the criminal justice system. For us to maintain any hope of social change, these issues need to stay in the public view and I appreciate the many fine articles in your journal on this topic.

FMHAC sponsors a conference each year focusing on these issues. Some of the authors in your recent journal are presenting at our conference and are actively involved with our association. This year's conference will be held in Seaside, Calif., from March 15 to 17. We offer continuing education units for MDs, RNs, social workers, psychologists and correctional officers. Additional information is on our website www.fmhac.net. Again, thank you for your excellent work.

Sincerely,

Officer Joel Fay, PsyD

President, Forensic Mental Health Association of California

Senator Speier To Receive Dr. Nathan Davis Award

The San Francisco Medical Society is pleased to announce that Honorable Jackie Speier, its nominee for the 2006 American Medical Association Dr. Nathan Davis Awards, has been chosen in the category of State Legislator.

The awards, presented to local, state and federal career and elected government officials, were established by the AMA in 1989 and are one of the most prestigious forms of recognition for outstanding public service in advancement of public health.

The officers of the AMA will present the awards at a banquet in Washington, DC, on March 14, 2006. Generally, over 500 health sector representatives, as well as members of Congress and administration officials attend this dinner each year. SFMS Officers and Executive Director Mary Lou Licwinko will join Senator Speier at the banquet, along with other leaders from the CMA and SFMS.

Anyone interested in joining the SFMS banquet table should contact Mary Lou Licwinko at (415) 561-0850, ext. 237, as soon as possible.

Philip R. Lee, MD, and Steve Heilig, MPH

Introduction

The Mainstreaming of Environmental Medicine and Health

This issue of *San Francisco Medicine* is the third "Environmental Health" edition we have presented in as many years, following a landmark conference hosted by the San Francisco Medical Society in 2002. These special editions of the journal have been very popular among readers in terms of reprint requests, online access and other feedback. Our authors have been drawn from among the nation's leaders in scientific, educational and policy advancement in this field. We are very pleased to continue that standard with this latest installment. Those who seek more information are encouraged to visit the information-packed new website of the national network launched at the SFMS meeting, the Collaborative on Health and the Environment: www.healthandenvironment.org.

As the evidence gains ever more credibility that environmental factors—particularly chemicals—are factors in many human health conditions, previously skeptical scientists and others lend their support to further the goals of environmental health advocates. The American Heart Association released a landmark report and initiative on environmental cardiology; reports from publications ranging from *JAMA* to the *Wall Street Journal* gave credence to arguments that researchers concerned about toxins have been making for years. Physicians and scientists signed on to consensus statements of concern, including one in Europe signed by some of the world's leading researchers—some of them Nobel Prize recipients. Europe's leading medical associations called for a strict legal framework for chemicals as such a policy wound its way toward approval by the European Parliament and eventually, we hope, the nations of that continent—thus requiring safety testing for thousands of compounds widely used in everyday products. Europe may be ahead of the U.S. in this regard, but our own FDA's approach to pharmaceuticals, flawed though it may be, sets a precedent here as well.

The scientific themes underlying such efforts and policies—that low-dose exposures can have impacts as significant as higher exposures; that developmental exposures in utero and in children can have lasting, delayed lifetime impacts; that mixtures among the many chemicals within us can have synergistic negative impacts—are fascinating and sometimes revolutionary. This research is important. We do need to know more, using established and new tools, but need not wait for "more research" to take protective actions using accepted public health strategies. There are many lessons, especially from the tobacco wars, that could guide policy for environmental chemicals.

One of the lessons in public health history is that physician leadership can be very effective, even crucial, to improvement in practice and policy. From the earliest public health initiatives for cleaner water onward, physicians, both as individuals and in organizations, have played a crucial, even catalytic, role.

The inspiring case of Herbert Needleman, MD, regarding lead toxicity in children is an important example in environmental health. The tobacco issue is another. Leading environmental health scientist and clinician Ted Schettler, MD, MPH, tirelessly teaches about this issue nationwide and has observed that no medical association to his knowledge has taken on such an active leading role as the SFMS.

It is our hope that more and more physicians and their professional organizations will become convinced by the ever-growing scientific and epidemiological evidence that some of the more than 80,000 industrial chemicals in use, many of which have now been demonstrated to be present in all our bodies, need not and should not be there. And we hope that then, as happened with tobacco and other such threats, the medical profession can lead actions to decrease exposure and improve the diagnosis and treatment of those affected.

We are proud to present some of the field's top voices in this special edition. The SFMS will also, in partnership with other health organizations, hold a major conference on these topics in October. Please read on, stay tuned, and join the thousands of concerned professionals who have joined the Collaborative on Health and the Environment.

Philip Lee is a professor at Stanford University and UCSF (where he is also Chancellor Emeritus), a former United States Assistant Secretary of Health, and Chairman of the Collaborative on Health and the Environment. Steve Heilig is Director of Public Health and Education for both SFMS and the Collaborative on Health and the Environment.

Toward an Ecological View: Complex Systems, Health and Disease

Ted Schettler, MD, MPH

Complex relationships among genetic, biologic, toxicologic, nutritional, geologic, economic, political, social, cultural and historical phenomena are major determinants of health or disease. The dominant scientific approach to understanding this complexity involves taking it apart in order to examine more manageable pieces. That approach emphasizes the role of parts and de-emphasizes relationships. Then, in an attempt to understand some larger whole, scientists often construct models built of selected individual variables from the ground up, referring to "independent" variables that combine to determine the "dependent" outcome of interest.

Clinical medicine, and to a large degree public health practice, favors examination of individual risk factors when trying to understand the causes and distribution of disease. In many instances that approach has been enormously fruitful and has led to important medical and technological achievements. However, models built of individual risk factors have explanatory limits. They are necessarily impoverished representations of profound multidimensional system complexity—in the individual, community, and ecosystem.

Multiple interactions among variables, positive and negative feedback loops, and nonlinear system dynamics determine the health and behavior of individuals, populations, and entire ecosystems. System behavior depends on specific circumstances and often fluctuates around a mean. However, exaggerated oscillations or near-threshold conditions can create vulnerability to small perturbations that can propel the entire system into new dynamic operating conditions. Studies that ignore details of system conditions will miss important real-world determinants of health in complex interactive systems.

> "Even when corrected, iron deficiency in infancy appears to have long-term consequences, with reduced mental functioning and increased behavioral problems in children evaluated at 10 years of age. Children in poor social circumstances seem to be particularly affected."

In humans, homeostatic mechanisms work to maintain favorable physiologic conditions, but sufficient external stress can exceed the buffering capacity of the system or cause adaptive responses with their own adverse impacts. In individuals, the result may be illness or premature death. In populations of people, changes in system conditions can cause the emergence of new patterns of disease or behavior. Ecosystem changes may favor certain populations, and some species may find new system dynamics inhospitable. These are the driving forces of evolutionary biology.

Most medical conditions do not have single "causes" or single necessary antecedents. Typically, a number of factors are linked together in complex causal webs, in a context of susceptibility. At best, we can say that some collection of factors increases the risk of a disease but their relative contributions may vary considerably from one circumstance to another.

The strength of association between an exposure and disease is fundamentally affected by the prevalence of other component causes in a given context. What is unimportant in one set of circumstances may be very important in another. Commonly used statistical models intended to describe relationships among multiple risk factors, including multiple regression analyses, are often

Continued on page 13

unable to capture the complex heterogeneity of real world circumstances.

The combined and independent impacts of dietary iron deficiency, lead exposure and social conditions on brain development of children illustrate some of these points. These three variables of course are not the only determinants of childhood brain development, but they are important. Awareness of their interactive, combined effects is essential for designing effective public health interventions.

IRON DEFICIENCY, LEAD EXPOSURE, SOCIAL CIRCUMSTANCES AND BRAIN DEVELOPMENT IN CHILDREN

Many studies show that developmental low-level lead exposures are associated with persistent cognitive impacts and behavioral changes. Blood lead levels around two or three years of age are particularly important for their impacts on cognitive development.

Iron deficiency is probably the world's most common single nutrient deficiency. About 10 percent of toddlers in the U.S. are iron deficient and the prevalence is substantially higher in non-Hispanic blacks, Mexican-American females and Alaskan natives. Children who are iron deficient are at risk for cognitive deficits, even if they do not have anemia that is often associated with this nutritional deficit. Studies of the impact of treatment of iron dedeficiency anemia are inconsistent though most conclude that children continue to exhibit lower academic performance, even after the anemia is corrected.

A number of studies have documented a correlation between iron deficiency and elevated lead levels, particularly in younger children. Iron deficiency may amplify the effect of environmental lead contamination by increasing absorption and retention by increasing absorption and tetention by increasing hand-to-mouth behavior and, hence, lead ingestion.

Despite their correlation, iron deficiency is not essential in the pathway between lead exposure and cognitive impacts. Lead also has effects on cognition that are independent of iron status. Iron is required for neurotransmitter synthesis and myelination. Lead can disrupt cell proliferation, differentiation, synapse formation, myelination, and programmed cell death, as well as altering neurotransmitter levels.

Studies of the impact of interventions that reduce blood lead levels have variable results. The children who benefit most from lead level reduction appear to be those whose iron status is sufficient. Lead level reduction in children who are iron deficient does not seem to improve cognitive performance.

Even when corrected, iron deficiency in infancy appears to have long-term consequences, with reduced mental and motor functioning and increased behavioral problems in children evaluated at 10 years of age. Children living in poor social circumstances seem to be particularly affected, whereas more enriched social circumstances tend to blunt the impacts of early iron deficiency on mental functioning.

This example points to a deeply rooted problem: Focusing on individual risk factors often does not honor the complexity of systems of interest. Other examples from animal and human studies also illustrate the interpenetration of nutritional status, exposure to toxic chemicals, and mammalian biology:

- Nutritional status can modify the carcinogenic risk of exposure to carcinogens.
- Nutritional status can modify the teratogenic risk of exposure to teratogens.
- Dietary selenium reduces the toxic impacts of mercury.
- Maternal social and economic deprivation increase the neurodevelopmental impact of prenatal exposure to chlorpyrifos in offspring.
- Omega-3 fatty acids in fish reduce the cardiovascular toxicity of mercury.
- Mercury decreases the beneficial effects of omega-3 fatty acids on brain development.
- Omega-6 fatty acids increase atherosclerosis caused by PCB exposure while plant-derived antioxidants protect against this effect.

The prevailing paradigm resists framing cognitive impairment, cancer, or birth defects as ecological outcomes—outcomes inherent in a particular ecosystem—and favors conceptualizing these as problems in individuals to be explained by individual risk factors and understood using primitive models.

Identifying individual risk factors has been very helpful for understanding major determinants of certain diseases like lung cancer and heart disease. Perhaps, however, we should be thinking about diseases that are resistant to a risk-factor approach, such as breast and prostate cancer, many birth defects, or neurodevelopmental disorders, as ecological manifestations of multiple changes in the dynamic system in which people are conceived, develop, live and grow old.

It seems unlikely that we will truly understand the origins and prevalence of these conditions and be able to design preventive strategies by looking just at individual risk factors. These are conditions that emerge from complex systems, and we do not understand their ecology well enough. Effective prevention is more likely to be realized when top-down systems analyses are added to a bottom-up individual risk factor approach. Biologists, epidemiologists, clinicians and the general public must be willing to expand their horizons, learning from ecologists and other integrative disciplines.

New approaches may be fruitful in

Continued on page 15

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Complex Systems, Health & Disease

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three areas: how we imagine the world, how we study the world and how we respond.

Many different social and cultural institutions could address these three areas, including education, research, medical care, public health, governmental agencies, businesses, religious organizations, the nonprofit sector and philanthropy.

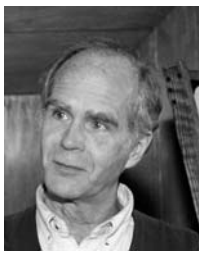
Ecology and evolutionary biology should be introduced early into primary, secondary, college and graduate education to supplement a reductionist, bottom-up approach with a top-down systems perspective.

Efforts at cross-disciplinary research and collaboration are likely to offer new insights. New epidemiologic and statistical techniques should be employed to deal with system interactions, feedback loops, and nonlinear system dynamics. Methods used in the ecological and social sciences may have much to offer the biological sciences in furthering understanding.

Traditional clinical medical care tends to focus primarily on individual risk factors and therapies directed at modifying them individually. A more integrative approach that simultaneously addresses a number of relevant factors may hold promise for enhancing the systemic health of individuals and populations, as well as addressing the health of entire ecosystems.

Businesses, health care facilities, local and regional governments, farmers, agricultural institutions and religious organizations, among others, could be encouraged through a variety of incentives to modify or expand their spheres of concern to entire ecological systems in which they operate. New economic analyses that are better indicators of ecological health, rather than simply monetary growth, are needed. As it is, "silos" of specialization encourage a focus on single risk factors or metrics, with little attention to entire systems in which those factors operate.

How might we address malnutrition, food production systems, soil and water quality, exposure to carcinogens and other toxicants, and socioeconomic stress collectively? How would this change the structure and approach of educational, scientific, medical and civic institutions? Can we continue to hope that a haphazard collection of interests, ideologies and civic and governmental institutions developed long ago will contribute to ecosystem resilience that will remain favorable to continued human survival on a finite planet over time?



Dr. Ted Schettler holds a medical degree from Case Western Reserve University and a masters in public health from Harvard University. He is science director of the Science and Environ-mental Health Net-work. (www.sehn.-org). Dr. Schettler also coauthored Generations at Risk *(MIT Press, 1999) and* In Harm's Way—Toxic Threats to Child Development, *(Greater Boston Physicians for Social Responsibility). He on the medical staff of Boston Medical Center and has a clinical practice at the East Boston Neighborhood Health Center.*

Air Pollution and Heart Disease: Recent Developments

Michael Lipsett, MD

Cardiovascular disease is by far the largest cause of mortality in the U.S. population. While several individual biological characteristics, such as hypertension, diabetes and cholesterol levels, have long been known to represent important risk factors for the development of disease, there has been relatively little scrutiny in the clinical literature of the role of the environment in the etiology of circulatory disease or in the precipitation of acute events. However, in environmental health and epidemiology journals, scores of studies conducted on five continents have documented consistent associations between acute (i.e., 24-hour) exposures to ambient air pollution and daily mortality, especially among older individuals with preexisting cardiac and respiratory diseases.[1]

These findings are supported by numerous reports linking ambient concentrations of several pollutants, notably particulate matter (PM), carbon monoxide and ozone, to hospitalizations for cardiovascular events.[1] These remarkably consistent associations suggest that exposure to ambient air pollution is a risk factor for exacerbation of preexisting cardiac illnesses, though pathophysiological mechanisms are still incompletely understood.

Of particular research interest is the relationship between traffic emissions and occurrence of acute events and possibly chronic illness as well. Traffic emissions consist of a heterogeneous mixture of biologically active gases, such as nitrogen oxides and carbon monoxide and particulate matter (PM), which includes diesel soot, condensed combustion gases, tire fragments and entrained dust and soil. The concentrations of all of these and other traffic emissions vary in both time and space, with the highest concentrations near busy roads. Within the many pollutants associated with traffic, researchers have focused especially on fine and ultrafine PM, both of which can easily penetrate to the deep lung and, in the case of ultrafine PM, translocate into the blood to be transported throughout the body. Fine PM is 2.5 micrometers or less in diameter, while ultrafine PM is even smaller: 0.1 micrometer or less. By comparison, a human hair is typically 50 to 60 micrometers in diameter.

Last year German investigators published the results of a study examining the activities of 691 myocardial infarction (MI) survivors during the four days before they had symptoms.[2] They reported a statistically significant near-tripling of the risk of MI within one hour of having been in traffic compared with other times when the subjects were not in traffic. This association was present regardless of whether the subject had been in a car or public transportation, or on a bicycle or motorcycle. Statistical adjustment for potential effects from the degree of exertion on a bicycle or from getting up in the morning decreased the estimate of this association by less than 10 percent. The observation that the effect was present for individuals taking public transportation suggests that the relationship could not be explained solely by the stress associated with driving a car.

Another biologically plausible explanation for at least some of the epidemiological findings linking air pollution and acute cardiovascular events concerns disturbances of the autonomic regulation of the heart, which are often measured as alterations in heart rate variability (HRV). HRV describes changes in consecutive normal sinus beat-to-beat intervals; decreased HRV has been associated with sudden cardiac death and mortality from heart failure. At least half a dozen studies have linked ambient fine PM with transiently decreased HRV. One recent paper found that the black carbon fraction of PM2.5, which is primarily found in vehicular (particularly diesel) exhaust, was more strongly associated with

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HRV decrements than other subcategories.[3] Other work has shown associations between pollutants and electrical discharges of implantable defibrillators, again with the strongest associations linked to vehicular emissions.

In contrast to the plethora of environmental epidemiological studies linking daily mortality or cardiovascular hospital admissions with ambient air pollution, there are but a handful examining the relationship between long-term exposure to air pollution and mortality from cardiopulmonary disease. The largest of these involved an examination of the mortality experience of over 500,000 adults in 151 U.S. cities who participated in the American Cancer Society II (ACS) cohort.[4] After controlling for individual risk factors such as smoking, occupational exposures, body mass index, alcohol consumption, diet, and co-pollutants, a 10 microgram/m3 increase in the annual average concentrations of fine particles in these metropolitan areas was associated with significant increases in relative risks (RR) for total cardiovascular mortality (RR = 1.12, 95 percent CI 1.08 - 1.15), as well as for specific cardiac causes of death, including ischemic heart disease (RR = 1.18, 95 percent CI 1.14 - 1.23) and a combined mortality category of arrhythmia, heart failure or cardiac arrest (RR = 1.13, 95 percent CI 1.05 - 1.21).[5]

Increased risks of mortality were also observed in relation to several other pollutants, including sulfur dioxide and sulfate particles (both arising mainly from fossil fuel combustion) and summertime ozone. Interestingly, however, the increased risks of mortality were limited to the group without formal education beyond high school, suggesting that one or more factors associated with educational attainment modified the effect of air pollution. Such factors could include nutrition or residential location in relation to busy streets. A smaller Dutch cohort study found that an individual's exposure to air pollution may vary as much within a single city as across different cities.[6] In that study, involving 5,000 adults followed up for eight years, the authors found that exposure to traffic-related air pollutants was more strongly related to mortality than were citywide background air pollution levels. While the investigators measured pollutant exposures in a variety of ways, the metric most strongly associated with cardiopulmonary mortality in this cohort was whether a subject lived near a major road (RR = 1.95, 95 percent CI 1.09 - 3.52).[6]

During the last decade, the state of knowledge about the relationship of air pollution to cardiovascular disease has advanced from extensive ignorance to a point where the American Heart Association (AHA) could publish a thorough review of this area, with an implicit recognition of a causal relationship.[7] The AHA review found that exposure to air pollution could "accelerate the development of coronary atherosclerosis and worsen its sequelae," stating further that "some of these effects may occur over time, as with acceleration of the progression of atherosclerosis, or rather abruptly, as with the triggering of an arrhythmia or myocardial infarction by acute inflammatory responses, altered platelet adhesiveness, or perhaps vascular endothelial dysfunction." As noted above, recent work suggests marked increases in risk for traffic-associated acute events, such as myocardial infarction. Given that motor vehicle exhaust and other sources of ambient air pollution are ubiquitous, especially in urban areas, it is reasonable to consider that exposures to PM and other pollutants present a significant risk to public health.

Dr. Lipsett is chief of the Exposure Assessment Section in the California Department of Health Services and an associate clinical professor at USCF. For nearly two decades he was responsible for developing the medical basis for California's ambient air quality standards. He has served on numerous local, state and national committees focusing on air pollution and health, including the American Heart Association's Expert Panel on Population and Prevention Science, which produced that organization's recent statement on air pollution and heart disease.

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Environmental Contaminents and Human Fertility

Linda C. Giudice, MD, PhD, Alison Carlson and Mary Wade

In late February 2005, the Stanford University School of Medicine's Women's Health @ Stanford Program and the Collaborative on Health and the Environment (CHE) convened a workshop titled "Understanding Environmental Contaminants and Human Fertility: Science and Strategy." This meeting of 40 infertility and reproductive health experts, held at the Vallombrosa Center in Menlo Park, was the first to bring together researchers in reproductive epidemiology, biology, toxicology and clinical medicine with representatives of relevant professional societies *and* infertility patient support, women's health and reproductive health advocacy organizations from the United States to assess the state of the science on environmental contaminant impacts on fertility.

The purposes of the meeting were to:

- Review findings from diverse research disciplines concerning links between environmental contaminants, specifically chemicals and heavy metals, and fertility compromise, with special attention to critical recent discoveries in related basic sciences;
- Identify conclusions that could be drawn with confidence from existing data;
- Identify critical knowledge gaps and areas of uncertainty, and establish key elements of a coherent research agenda to help fill gaps and resolve uncertainties;
- Gather diverse stakeholders in environmental reproductive health to promote access to scientific expertise for lay and medical professional groups, and build a community of informed voices in support of enhanced research programs and funding; and
- Consider recommendations for educational initiatives and preventive interventions if and where warranted.

The Vallombrosa workshop resulted in publications that together provide a solid overview of environmental reproductive health (ERH). They are intended to increase public, patient, reproductive health professional, advocate, policy maker, and fellow scientist attention to the central issues addressed at the meeting, and move ERH research forward.

Vallombrosa Consensus Statement on Environmental Contaminants and Human Fertility Compromise summarizes participant consensus on core points of scientific agreement, arranged according to a hierarchy reflecting what experts are confidant or certain of, what is "likely but requiring scientific confirmation," and what is uncertain and a priority for further investigation. The statement is posted in downloadable PDF format at www.healthandenvironment.org/working_groups/fertility as well as on the website of the University of California, San Francisco Department of Obstetrics, Gynecology and Reproductive Sciences at http://obgyn-nw.ucsf.edu; and in an interactive format at www.ourstolen-future.org/consensus/2005/2005-1030vallombrosa.htm.

Challenged Conceptions: Environmental Chemicals and Fertility is a companion monograph for lay readers as well as health and policy professionals. It provides a general introduction to the science; tables showing the main contaminants of concern listed with sources of common exposures and associated fertility/fecundity-related effects; a summary of patient advocate and clinician concerns expressed at Vallombrosa; and a list of resources for further information. An addendum on human biomonitoring addresses questions that patients and physicians may have about this method of assessing one's exposures to environmental agents. *Challenged Conceptions* is available in hard copy booklet form as well as online at www.healthandenvironment.org/working_groups/fertility.

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Seminars in Reproductive Medicine will publish proceedings of the scientific overview presentations at Vallombrosa in an early 2006 issue.

The workshop program was cochaired by University of Rochester–based ERH researcher and reproductive epidemiologist Shanna H. Swan, PhD, and Linda C. Giudice, MD, PhD, who then was director of Women's Health at Stanford and the Stanford OB/GYN department's Center for Research on Reproduction, Women's Health and Genomic Medicine. Dr. Giudice has since become professor and chair of the Department of Obstetrics, Gynecology and Reproductive Sciences at University of California, San Francisco, where she is establishing a program on Reproductive Health and the Environment. A list of Vallombrosa participants and the workshop description, program and bibliography can also be found at www.healthandenvironment.org/working_groups/fertility.

IS INFERTILITY ON THE RISE?

In recent years there have been sharp increases in the number of annual doctor visits for fertility problems; of couples diagnosed with infertility; and of people seeking infertility treatments. Demographers attribute these increases to greater reporting as a result of the availability of ever more effective assisted reproductive technologies as well as voluntary delays in first pregnancy in a large generation of baby boomers at reproductive age over recent decades.

There are indications, however, that the actual incidence of infertility itself may also be on the rise. Rates of certain medical conditions that can contribute to infertility, such as testicular cancer, cryptorchidism, hypospadias and endometriosis, are rising—and the most recent (2002) National Survey of Family Growth from the National Center for Health Statistics indicates that 12 percent of the reproductive-age population in the United States (7.3 million couples) now reports experiencing difficulty conceiving and/or carrying a pregnancy to term—as compared with 10 percent (6.1 million) in 1995 and 8 percent (4.9 million) in 1982 and 1988. While self-reported impaired fecundity is up in all reproductive age groups, the most dramatic rate of increase is actually *in younger women, under age 25*: a 42 percent rise between 1982 and 1995, as compared with a 12 percent increase in women ages 25 to 34, and only 6 percent in women 35 and older over the same time period. These data suggest that delays in childbearing may not fully explain the apparent upward trend.

GROWING EVIDENCE OF ENVIRONMENTAL IMPACTS

A growing body of research is revealing that a larger portion of human health problems may be related to environmental contaminant exposures than was thought possible even a decade ago. Scientists are now concerned not only about high-level exposures (related mostly to certain occupations or industrial accidents), but also about lower "environmentally relevant" exposures commonly experienced by humans worldwide. Environmental health researchers are looking at questions of whether and specifically how contaminants might be contributing to human fertility problems—perhaps even contributing to an actual rise in the incidence of infertility—and biological plausibility is increasingly being demonstrated.

Striking evidence of environmental chemical impacts on reproductive health and fertility came first from observations of wildlife over recent decades, amply described in the 1996 book *Our Stolen Future*. Hundreds of wildlife studies strongly link manmade endocrine-disrupting chemicals with declines in reproductive rates and a host of reproductive abnormalities in a wide range of bird, reptile, fish and mammalian species. Numerous studies in laboratories around the world confirm that synthetic chemicals at environmentally relevant levels can cause reproductive damage in experimental animals. More recently, a smaller number of human studies reveal associations between environmental toxicants and parameters known to affect reproduction and fertility.

Collectively, effects associated with environmental chemical exposures in wildlife, lab animals and humans include increases in medical conditions or anatomical defects associated with infertility; reduced sperm count and quality; sperm DNA damage; sterility; alterations in ovarian function and menstruation; oocyte quality and cytogenetic damage; longer time to pregnancy; altered implantation rates and embryonic development; and increased rates of spontaneous miscarriage, preterm birth and stillbirth. Population-level shifts have also been correlated with environmental exposures, for instance, alterations in twinning rates or sex ratios in specific populations.

While a handful of the impacts observed are frank, many—such as increased time to pregnancy and reduced sperm counts—are better characterized as subtle "hits" on reproductive robustness. But this still raises a question: What might be the consequences to our species of multiple subtle reproductive system insults over the longer haul? Especially given that:

- Some 80,000 or more chemicals have been registered for commercial use in the United States over the last 80 years; a growing number of them are being identified as reproductive toxicants; and some of the "bad actors" are notably persistent in the environment and our bodies—while others are nonpersistent but ubiquitous/chronically present.
- In contrast to regulation imposed on the pharmaceutical manufacturers, there is no requirement that chemical manufacturers health-test their products—other than new kinds of pesticides and some food additives—in advance of bringing them to market.
- Measurement, or biomonitoring, of contaminants in people shows that

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Standing Up to the Lead Industry: An Interview with Herbert Needleman, MD

Note: This interview is excerpted from a longer original version that appeared in Public Health Reports *2005:120; 330-337. It was conducted by David Rosner, PhD, and Gerald Markowitz, PhD, of Columbia University. The full version, with references, is available at: http://www.public-healthreports.org.*

Herbert Needleman, MD, is a pioneer in the history of medicine who has helped transform our understanding of the effect of lead on children's health. In the 1970s, he revolutionized the field by documenting the impact of low lead exposure on the intellectual development and behavior of children.

Not surprisingly, Needleman became the focus of the lead industry's ire. Beginning in the early 1980s, the industry's attacks on his research and use of public relations firms and scientific consultants to undermine his credibility became a classic example of how an industry seeks to shape science and call into question the credibility of those whose research threatens the industry's economic interests.

On the one hand, the industry explicitly showed the power it had to disrupt researchers' lives if they dared to question the safety of its products. On the other hand, Needleman's experience galvanized a generation of researchers who were profoundly influenced by the implications of his studies. Others have built on Needleman's work, confirming his findings as well as opening new areas of research that have shown that lead exposure, at virtually any level, has negative, life-altering consequences for children. This interview, conducted on the eve of his 75th birthday, recounts a small part of Herbert Needleman's experiences over the course of the last half century.

Let's start with a little background about your family and your education.

I'm a Philadelphian by birth. I was the first person in my family to go to college. I went to Muhlenberg College in Allentown, Pennsylvania, and then to the University of Pennsylvania Medical School. I interned at Philadelphia General Hospital. I had initially intended to be an internist, but I discovered I was having much more fun in pediatrics.

In those days, the government was subsidizing general practitioners and pediatricians to go into psychiatry because they thought we needed more psychiatrists. I was going to be a child psychoanalyst. I was very unhappy with the training, and the theoretical basis of child psychoanalysis didn't satisfy me. I kept thinking, "How many of these kids who are coming in with learning problems have lead poisoning?" The inner city neighborhood we served had a lot of lead. People thought that was a crazy idea.

The experience that turned me toward studying lead is very clear in my mind. I was working on the infant ward at the Children's Hospital, and a child was bought up from the ER with severe acute lead toxicity. I did what I'd been trained to do. I gave her EDTA [chelation therapy]. She was stuporous and very ill. Slowly she got better. It was a gratifying experience and I felt very smug. I told the mother that she had to move out of that house: "You cannot go back to that house because if she has a second episode she's going to be retarded." This was what I'd been trained to do in medical school. She looked at me and said, "Where am I going to move to? All the houses I can afford are the same age." I suddenly realized that the issue was not just making diagnoses and treating them. The issue was in the life story of people. This was a very powerful learning experience.

I thought, how many of these kids who are coming to the clinic are in fact a missed case of lead poisoning? My office looked out on a school playground. I watched the kids every morning line up and go to school. I said, "I'm going to go into that school and identify the children who have elevated lead and see what their IQs are." Then it occurred to me that the blood lead at 6 years of age might by then be normal if the exposure had occurred at less than 2 years of age. So I began to think: "What can I use to read back in their exposure history?"

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Then it occurred to me there's a way to do a spontaneous bone biopsy. It's universal, spontaneous and painless. You just have to catch a deciduous tooth. I collaborated with a dentist in the dental school. [We] collected a lot of teeth from inner-city and suburban kids. The tooth lead levels in the inner city kids were five times what they were in the suburban kids.

How did you publicize your findings?

We talked to the city, and we published in the *New England Journal of Medicine*. Years later there was a lawsuit on behalf of the people who lived there. A Washington law firm won an award of a million dollars.

Were there any issues with the industry other than at government meetings?

In 1979, when I published that paper, the lead industry was silent. They didn't say anything for about six months. I expected that there would be a big response, but there was nothing. Then they started to call for my data, my printouts, and I said, "No. I'll share them with any legitimate scientist, but I'm not going to share them with the lead industry because they don't qualify."

[In 1991], I got a brief that accused me of scientific misconduct. It was submitted by a guy named David Geneson. He is an attorney with Hunton and Williams. Hunton and Williams is interlocked with Ethyl Corporation of America through its board of trustees. So he was the person who sent the charges down to NIH. The next thing I know, I was called by a reporter from *Science* magazine. I said, "Come on, this is just the industry trying to get me." I didn't realize how serious it was. The university called me and said, this is nothing to worry about. It will pass. The next thing I know they're going to have an inquiry. The NIH referred the investigation to the university. That's their procedure. My files were locked, and I could only look at my data in the presence of a representative of the Office of Scientific Integrity of the university. I had to call her up and say I wanted to look at some data: can you come and unlock the files? They put bars on my file cabinets. The inquiry committee was composed of three people from the University of Pittsburgh: two epidemiologists and a statistician. They looked at my data tapes and regressions and got the same results. They reported that they found no evidence of scientific misconduct but they could not rule out scientific misconduct. But the university said there was enough reason to go ahead with an investigation, which is the second phase of a scientific misconduct inquiry.

Did you have a group whom you were supported by? Other professors and medical people?

Well, it is a very clarifying moment when this happens. You learn who your friends are. My friends were not people in the medical school, but the faculty in the university at large, in the liberal arts and sciences, etcetera. They really stood behind me. The major issue was having an open hearing. I knew that if we went into executive session, I was through—I mean, just judging by the report that the inquiry committee wrote.

It went on for a day and a half. It took a long time for the committee to turn it around. They said there was no evidence of scientific misconduct in terms of false application or plagiarism; however, the way I reported my control group was misrepresented. The industry trumpeted that I had deliberately misrepresented the data.

So you are at the university and some of your colleagues have abandoned you—what's happening?

The faculty senate really backed me up completely. I felt I had friends. The dean of the School of Public Health at that time was a good friend of mine. Months had gone by of absolute silence, and now he took me out to lunch and we talked. I said, "Hey, Don, how come you never spoke to me when I was in the middle of all that melodrama?" He said, "Well, my wife thought I should, but I guess I was afraid." At least that was honest.

It raises the question of what effect you think the assault on you had. Was it meant to scare younger scholars away from doing controversial research?

I wrote about that in a piece in *Pediatrics*. If this is what happens to me, what is going to happen to somebody who doesn't have tenure? I'm worried that people who are trying to get a niche and don't have tenure are asked—and I've seen it as a member of the TAFC—to do things that they question the ethics of. They are intimidated. It's a real force.

What were the repercussions after 1991? Were you able to continue your work?

I think, all in all, that throwing light on [my experience] was healthy for the medical community—to see the way that certain people operate. So I think that was good.

Do you think we are ever going to find a threshold below which lead has no effect on children?

Most of the damage is done at very low levels, which is what we showed in our study in 1987. It's a very intriguing physiological problem. Why is it that the toxic effect of lead is stronger at lower doses? I have a couple of ideas. I think there is an early mechanism that is important and powerful that can be saturated by only a little bit of lead; you do that damage and then you need more lead to get the other targets activated. I think that's what some smart molecular biologist will be able to show. I think that at very small doses, these things happen because you don't need much. Then the next damage occurs on a different mechanism at a different level. All along there are different mechanisms that come into play that end in the neurophysiologic deficit. I don't think there is a threshold. Barry Commoner, who made me see this, says that we've had a billion years to adapt to natural molecules. By contrast, we've had only a couple thousand years to adapt to

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Interview with Herb Needleman, MD

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lead. Fifty years to adapt to pesticides. All of these are toxic at some level. But we have developed no adaptive biological mechanism for lead, which has no purpose at all in the body. There is no biological function, so any amount is going to be deleterious.

So you're still working away. You're now 75 years old. You certainly started a school.

I didn't start it. There were maybe six or seven papers before mine. What I did was develop a tooth assay, which was very useful. It answered the questions that were around at that time.

Does that explain in some sense why you became such a focus for the industry?

Yes! Sure. It's very clear to me that in 1990 there were already 30 papers from around the world all saying the same thing. The [lead industry] couldn't contest that, so what were they going to do? If they could discredit my work, the whole thing would collapse or be fundamentally revised. I'm sure that was it. That's why they kept saying they had to have my original data, because they had planned to make a concerted attack on [my findings]. Then all the other work that grew out of it would be . . .

Suspect?

Discredited.

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Contaminants and Human Infertility

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average Americans have hundreds of manmade chemicals, including a significant number of reproductive toxicants, in their tissues (including amniotic fluid and umbilical cord blood) at levels high enough to be of concern.

- There are critical windows of vulnerability, and it is very likely that some of the most significant reproductive compromise is what occurs as a result of in utero exposures—the effects of which may not become evident until decades later when an individual attempts to become a parent.
- Rapid recent advances show that low doses and mixture of chemical exposures matter—and that some chemical exposures may cause adverse intergenerational effects (through epigenetic alterations).

PATIENTS RAISE QUESTIONS, PHYSICIANS NEED ANSWERS

Infertility support organizations and physicians at the Vallombrosa workshop voiced concern that increasingly, reproductive health patients are asking whether environmental factors could be affecting their ability to conceive and bear children, or account for menstrual and other reproductive irregularities—yet most physicians are uncertain about how to respond, or even where to access reliable information on the subject. There is an obvious need for far greater environmental health content in medical school curricula and continuing medical education programs.

It should be noted, however, that infertility is distinguished by complexities that defy easy understanding, and multiple *interacting* factors are likely to contribute, including age, heredity, lifestyle choices, socioeconomic status, underlying disease, reproductive tract infections and nutrition. It will be challenging to pinpoint what proportion of human infertility is causally attributable to environmental exposures. Better prevalence/incidence tracking of infertility and its related conditions—and greatly expanded ERH research—will help. What *is* clear is that more complete understanding is critical. For if some proportion of infertility is environmentally induced, then that proportion is also, in theory, preventable.

JANUARY 2007 NATIONAL MEETING ON REPRODUCTION, FERTILITY AND THE ENVIRONMENT

The Vallombrosa workshop began an intriguing cross-discipline conversation. To continue it, CHE and UCSF and are now planning a larger "Summit on Reproductive Health, Fertility and the Environment" in January 2007. A key goal will be to expand health professionals' awareness of and engagement in ERH science and practice.

For further information, contact Mary Wade at wadem@obgyn.ucsf.edu or Alison Carlson, at alison@healthandenvironment.org.

Dr. Giudice is the professor and chair of the Department of Obstetrics, Gynecology and Reproductive Sciences, UCSF. Alison Carlson is a research fellow at the Commonweal Health & Environment Program and facilitator of the CHE Fertility/Early Pregnancy Compromise Work Group. Mary Wade is the coordinator for the program on Reproductive Health and the Environment, Department of Obstetrics, Gynecology and Reproductive Sciences, UCSF.

Chemical Exposure and Parkinson's Disease: A Plethora of Suspects

Jackie Hunt Christensen and Deborah Cory-Slechta, PhD

Parkinson's disease (PD) affects approximately 1.5 million Americans, making it the second most common degenerative neurological disease. Although there are four primary signs—tremor, rigidity, bradykinesia and postural instability—symptoms present differently in each patient. This complicating factor, combined with the lack of a biomarker or diagnostic test, makes it difficult for clinicians to diagnose the disease.

The majority of patients—around 95 percent—have no prior family history of Parkinson's. This point, along with a growing body of research, suggests that most cases of PD are caused, at least in part, by nongenetic factors. Most neurologists tell their patients, "Genetics loads the gun, but the environment pulls the trigger."

Several life experiences or demographics seem to increase the likelihood that a person will develop PD. These nongenetic risk factors include:

- Age
- Living in a rural area
- Viral infections
- Working as a welder
- Estrogen deficiency
- Drinking well water
- Significant head trauma
- Pesticide exposure
- Working as a farmer

For the purposes of this discussion, the focus will be on chemical exposure in the home and workplace.

TOXIC CHEMICALS

In a world with more than 80,000 chemicals in commerce, it should surprise no one that some of these substances are suspected of causing Parkinson's disease. Most studies are conducted on a chemical-by-chemical basis, or at best, mixtures of two or three compounds. This approach is unlikely to provide answers anytime soon, nor does it reflect the complex "soup" of chemicals to which people are exposed on a daily basis.

The first chemical connected with Parkinson's disease was MPTP. In 1982, some San Francisco Bay Area drug users who were attempting to synthesize heroin produced MPTP. Seven of these individuals developed Parkinson-like symptoms within weeks of their exposure to this compound. Today, MPTP is used in the laboratory setting to induce PD-like symptoms in research animals. It is also the standard against which other chemicals suspected of causing PD are measured.

Several classes of pesticides—bipyridyls, organochlorines, pyrethroids and carbamates—have been associated with effects on the brain that may contribute to PD. Certain particular pesticides—rotenone, paraquat, maneb—have been found to damage or destroy dopamine-producing neurons in laboratory animals. (See the chart on page 24.)

Several heavy metals have also been identified as having the potential to contribute to Parkinson's disease or increase the risk of developing it. All of these metals are associated with other health impacts, especially neurological problems. Those include aluminum, copper, iron, lead, manganese, and mercury.

SIGNIFICANCE OF IN UTERO, CHILDHOOD EXPOSURES

Scientists often use the maxim, "The dose makes the poison." Too often this is construed to refer only to the amount of a substance. But the timing of the exposure also plays an essential role in the effects, or lack thereof. A growing body of evidence indicates that exposures or insults occurring during childhood or even in utero may set the stage for the onset of cancers and chronic diseases in adulthood. PD may be no exception. Before adulthood, the organ systems are not fully formed or developed. An exposure or event coinciding with a developmental milestone could drastically alter the body's response during later milestones or insults.

This hypothesis has been tested in rodents exposed to maneb and paraquat shortly after birth. The animals challenged as juveniles experienced more neuronal damage than adults that were similarly exposed. They show a progressive neurodegeneration across their life, and as with human PD, males are at greater risk.

MECHANISMS OF ACTION

There are many ways in which substances in our environment or events that we experience can affect our brain and lead to PD.

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Chemical Exposure and Parkinson's Disease

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• They create free radicals that destroy neurons or affect the body's system of dealing with free radicals.

• They affect mitochondria, which are like the battery or power center in a cell.

• They kill neurons outright.

• They cause the production of alpha-synuclein, the protein that can build up to form Lewy bodies.

• They affect the apparatus of the cell that recycles proteins.

• They create inflammation that makes dopamine-producing neurons vulnerable to other insults.

• They affect cell receptors, which act as locks or gateways. The job of a receptor may be to open at a particular time to allow an enzyme or neurotransmitter to enter the cell and trigger a series of chemical reactions. Or it may be responsible for keeping out other brain chemicals. Any disruption in this gatekeeping process could have dire consequences, such as blocking instructions telling neurons to produce more dopamine.

In fact, exposure to multiple substances that produce different effects may result in a synergistic response that produces PD.

Substances in Our Environment Linked to Parkinson's Disease

Chemicals	Heavy Metals
• carbon monoxide	• aluminum
• carbon disulfide	• copper
• Pesticides: atrazine, chlorpyrifos (e.g., *Dursban®*), dieldrin, glyphosate (e.g., *Roundup®*), lindane, mancozeb, maneb, paraquat, rotenone	• iron
• polychlorinated biphenyls (PCBs)	• lead
• solvents	• manganese
Other	• mercury
• endotoxin	

Sources: Kamel and Hoppen; Liu, et al.

EXPOSURE PATHWAYS

Ingestion seems to be the most likely exposure pathway. Food, groundwater, and surface water may all contain pesticide residues. Some parts of the country have high levels of heavy metals that are naturally occurring in their water supply. Workers in some occupations, such as welding and farming, may incur exposure via inhalation or skin contact.

Many of the chemicals linked to PD are very persistent, meaning that the human body cannot break them down into smaller pieces and get rid of them easily. Everyone may be exposed to some pesticides on a daily basis, although in very small amounts. Some of these compounds build up (bioaccumulate) in the body, often in fatty tissues. Perhaps exposure to a certain threshold amount of a chemical at a particular stage of development is the reason that only some individuals who are exposed to a substance go on to develop Parkinson's disease.

Environmental exposures do not offer a clear picture of PD causation, but they do fill up enough of the frame to warrant continued and more in-depth scrutiny.

Jackie Hunt Christensen, BA, of Minneapolis, is co-coordinator of the Collaborative on Health and the Environment's Working Group on Parkinson's Disease. She has been involved in numerous environmental and health-related collaborative efforts for nearly 20 years. She is a cofounder and former coordinator of Health Care Without Harm: The Campaign for Environmentally Responsible Health Care. She also served as codirector of the Food and Health Program at the Institute for Agriculture and Trade Policy—a position she left in July 2004 because of Parkinson's disease. In October 2005, her book, The First Year: Parkinson's Disease, an Essential Guide for the Newly Diagnosed, *was published by Marlowe and Company.*

Dr. Deborah Cory-Slechta is director of the Environmental and Occupational Health Sciences Institute, a joint institute of the Robert Wood Johnson Medical School of the University of Medicine and Dentistry of New Jersey and Rutgers, the State University. She is also chair of the Department of Environmental and Occupational Medicine at the UMDNJ–Robert Wood Johnson Medical School. Dr. Cory-Slechta has served on numerous national research review and advisory panels, including committees of the National Institutes of Health, the National Institute of Environmental Health Sciences, the Food and Drug Administration, the National Center for Toxicological Research, the Environmental Protection Agency, the National Academy of Sciences, the Institute of Medicine, and the Agency for Toxic Substances and Disease Registry, Centers for Disease Control. Her research has focused largely on the contribution of environmental chemical exposures to developmental disabilities and neurodegenerative diseases, particularly on the role of pesticides in the Parkinson's disease phenotype.

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The Real Rx: Slow Food, Lively Places, Real Vitality

Richard J. Jackson, MD, MPH, Megha Doshi and Monica Rai

Although Bob is a new patient, you feel like you've seen him a hundred times. His chief complaint: "Doc, I just feel lousy. I've gained weight, I'm always tired, I hardly exercise and life isn't much fun." You learn that his relationships are struggling: he feels disconnected from his wife and kids, his sex life is absent, and his bosses are demanding and ungrateful. His BMI is over 30, his cholesterol and blood glucose are elevated, and he fits the criteria for depression. You start by recommending modest lifestyle changes but end up prescribing four different medications. Worst of all, you doubt this would benefit him as much as managing his diet, losing weight, exercising more, spending more time with family, working less, and getting enough sleep. As a doctor, you may feel helpless. Your patient is living in an environment and culture that make all your healthful advice futile and expensive medications with numerous side effects the norm.

Today's health care pages boast plenty of good news. Compared to a generation ago, we have better treatment for hypertension, heart attacks and depression and better surgical techniques. We can prevent many illnesses, and biotechnological breakthroughs detect diseases long before they strike. Meanwhile, today's doctors are overwhelmed with staggering rates of obesity and associated chronic diseases, skyrocketing health care costs in a confounding system and patients who are more depressed then ever. Almost two-thirds of Americans are now overweight or obese, up from 24 percent in 1960, and rates of heart disease, stroke, high blood pressure, arthritis and diabetes have increased at similar rates.

"Today's are overwhelmed with staggering rates of obesity and associated chronic diseases, skyrocketing health care costs, a confounding system and patients who are more depressed then ever. Almost two thirds of Americans are now overweight or obese. . .and rates of heart disease, stroke, high blood pressure, arithtis and diabetes have increased. . ."

Medicine has tried to respond with "fixes" like bariatric surgery for the morbidly obese and prescription drugs for the depressed and diabetic. In fact, 97 percent of health care dollars is spent on downstream treatments, while only 3 percent is spent on prevention. Prescribing and operating our way through depression, diabetes, heart disease, and obesity is no golden ticket to better health. In public health, the patient is the population. When the patient has a systemic disease, one aggravated by his or her environment, we need to find and treat the root cause, not just the rash or the fever. Pills and surgery may protect health in the short term, but quality health care depends on environments in which the healthy choice is the easy choice.

Good health requires more than regular check-ups, immunizations and preventive screenings. Prevention is bigger than individual health behaviors and begins earlier than an office visit. Prevention starts in our communities, is embedded in our social values, and should be essential to how we build our environments. The average patient spends only about four hours a year with you. The remaining 8,756 hours are spent out in his or her environment trying to apply what you teach.

Sadly, most Americans live and work in environments in which healthy eating, exercising and enjoying leisure time—important tools for preventing most health conditions—are not easy or convenient choices. The built environment is the foundation of our lives and cannot be neglected as we develop new solutions to illnesses and health conditions.

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The Real RX

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Let's go back to our new patient Bob. If he's like most Americans, his days consist of working and driving an increasing number of hours, eating fast and prepackaged convenience foods, and coping with too much stress. He probably drives about 440 hours each year—equivalent to 11 work weeks.[1] Soaring home prices leave him no choice but to live miles from work, schools and shopping. Only 10 percent of Bay Area residents can afford a home here, while approximately 60 percent can buy a home in Fresno and other Central Valley cities.[2] As a result, Bob drives over 10,000 miles a year, 250 percent more than his parents drove in the 1960s.[3] While Americans may continue dreaming of suburban utopia, the reality is white-knuckle commutes, too little time with those who love and care about us and the numerous related health problems encountered in almost every routine check-up.

Bob's environment makes driving so routine and necessary that it's easy to overlook the inherent health risks associated with it. Motor vehicle crashes cause more than three million injuries and claim some 42,000 lives each year.[4] Adults with long commutes and busy lives are tired, frustrated and distracted drivers. Over half of Americans admit to driving while drowsy,[5] and studies indicate that falling asleep at the wheel may cause one in five crashes.[6] Traffic has reached such annoying and epidemic levels that even mild-mannered Bob becomes an aggressive, lane-swerving tailgater in the car.

Then there are the less obvious driving-related health hazards. Too much driving can trigger high blood pressure, abnormal heart rhythms, sleep disorders, depression, and neck, shoulder, and back pain.[7] It makes us more vulnerable to colds and flu and less productive at work. It makes us spend more time in the hospital and take more sick days.[8] And it makes our air almost unbreathable. California, the nation's ozone capital, is home to nine of the nation's 10 most smog-suffocated counties.[9]

Our environments force us to spend more than half our lives sitting in a car or sitting at work, leaving less time and energy for physical activity. Eighty percent of trips of less than a mile are made by car.[10] When we can get out of our cars, there are few safe places to walk and often nowhere within reasonable distance to walk to. Our poorest patients live in "food deserts" that lack places to buy fresh fruits and vegetables but are saturated with fast-food restaurants and corner liquor stores. We tell our patients to exercise and eat well, but if their environments make it impossible to walk or play outside and to buy affordable healthy foods, our prescription goes unfilled.

Car-crazy communities also erode family life and mental health. A May 2001 *US News and World Report* article described the struggles of balancing family and social life with work and long commutes. Stockton psychologist Timothy Miller estimated that half the married couples he counseled suffered from "commuter-related stress." Many had moved to the Central Valley to escape high Bay Area home prices. The less expensive housing, however, came at a cost—couples argued more, spent less time with their kids, exercised less and were generally unhappy.[11] Community engagement and socialization also suffer when people drive more. In his book *Bowling Alone*, Harvard professor Robert Putnam found that every 10 additional minutes spent driving to work corresponds to a 10 percent drop in community involvement.

America's health is in bad shape. Our patients are more diabetic, more overweight and obese, more depressed and more prone to heart disease and back pain. More than 1 million children and teens take antidepressants. Over 50 percent of Californians are overweight, and 1.7 million Americans qualify for bariatric surgery. One of three children born today will suffer from diabetes, a disease that degrades their quality of life and can cost them their eyes, feet, kidneys and eventually their lives.

Unfortunately, our lifestyles and environments don't support the healthy choices we need to make. Few Californians live in walkable, bikeable communities. Most spend their days inside buildings and cars and have precious little access to open green space. Every commodity needed is just two freeways and three exits away. Meals are concoctions of processed fats, sugars and preservatives hawked by cartoons at school, grocery store check-out displays, and fast-food restaurants. American adults are overworked and take far fewer vacation days than their European counterparts. We spend twice as much on health care but have lower life expectancies and quality of life. Expensive medical treatments may create the illusion of a healthier population, but we spend more to treat and manage preventable diseases than we do to prevent them in the first place.

For example, obesity, overweight, and inactivity among California adults will cost $28 billion just in 2005. Paying for the 1.7 million Californians who qualify for bariatric surgery would cost $52 billion, five times the state budget deficit. We literally cannot afford to operate and medicate our way out of these serious health conditions that are exacerbated by poorly designed environments.

Our deteriorating health and deteriorating environments are not isolated conditions. Health is inextricably linked to our broader environment and institutions—schools, workplaces, hospitals, neighborhoods and local governments. Hundreds of studies confirm this connection, but the findings are unintelligible to most people unless communicated by health experts they respect.

That's where doctors can enter the equation. We have the power to impact health, both in and out of the office. With our patients, we can measure BMI at every visit. Write a prescription for exercise. Emphasize the importance of reducing work and commute hours and spending more time with family. Sex and exercise are better than Zoloft and caffeine for depression. And, most important, we can ourselves be

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Choosing Sustainability: Paths to Green Chemistry in California

Michael Wilson, PhD, MPH

Green chemistry — developing materials and processes that are safer and more efficient, have less environmental impact and, most important from an industry standpoint, are more profitable — is a potent concept supported by business, industry and academia. It is changing how America lives and works.

William F. Carroll, Jr. PhD
President, American Chemical Society[1]

Over the next 45 years, the population of California is expected to grow by about 50 percent, from 36 to 55 million residents. During this period, we will face a growing set of social, economic and environmental problems. The *magnitude* of these problems—particularly as experienced by Californians in 2050—will be determined by the kinds of decisions we make in the coming years. If our desire as a society is to reduce the magnitude of these problems over time, it will become increasingly important in public policy, business planning and other areas of decision making to link economic growth with actions that advance environmental and social sustainability. In practice, this means that strategies to expand industrial capacity and employment in the state must simultaneously *solve* social and environmental problems. Policy strategies that support and motivate industrial investment in cleaner technologies represent one path that begins to meet this objective.

Chemicals policy is a fundamental player in this arena. Strategies to address public and environmental health concerns related to chemicals can and should be linked with efforts to improve California's productive capacity in the design, manufacturing and use of cleaner chemical technologies, known collectively as green chemistry. Green chemistry *products* are less toxic, they do not accumulate in the body, and they break down more readily in the environment. Green chemistry *processes* generate less hazardous waste and use less energy. A number of leading California firms are already employing elements of green chemistry in various forms, from innovative environmental stewardship programs to the design and use of chemical feedstocks and products that appear to be inherently safer for human biology and ecosystems.

While the science of green chemistry is in its infancy, and the business case for green chemistry has yet to be fully established, it is becoming clear that cleaner technologies, including green chemistry, will play a key role in the future of industrial activities among the nations of the world, both developed and developing. Global leadership has already begun in the form of substantial new policy directives related to electronic and electrical equipment—and most recently, to chemicals—in the largest, richest market in the world: the European Union.[1] By implementing strategies that support and motivate investment in green chemistry technologies, California could become a global leader in this arena.

The chemical industry has played a key role in economic growth, employment and improvements in life expectancy, health and living conditions.

Chemicals policy is challenging because the chemical industry produces fundamental benefits to society as well as a number of (less tangible) problems that affect downstream businesses and industry, public health, and government. The contributions of the industry to economic growth, employment and improvements in life expectancy, health and living conditions over the last 150 years are widely acknowledged.[2-5] Since the early 1900s, the U.S. chemical industry has been the largest in the world[2] and now accounts for about 26 percent of total global chemical production.[6] In 2002, U.S. businesses purchased $288 billion in U.S. chemical products, and the industry's exports totaled $81 billion—more than for either agriculture or aircraft/aerospace.[7]

In 2002, the U.S. chemical industry directly created more than one million high-paying jobs, each of which generated five additional jobs elsewhere in the economy.[7] The industry paid $24.5 billion in federal, state and local taxes.[7]

In California the chemical industry employs about 81,000 people;[3] another 500,000 people are employed in sectors that depend on chemical industry activity in California and other states. Together, these jobs produce $28.6 billion in earnings and $1.7

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billion in state and local tax revenues each year. Overall, industries for which 10 percent or more of material inputs are derived from chemicals employ more than 4.3 million Californians, or about 29 percent of all employment in the state.

Because economic status is a key driver of health, and most benefit programs—such as health insurance—in the U.S. are tied to employment, the contribution of the chemical industry to health status in the U.S. is substantial.

Clearly, as feedstock or as finished products, synthetic chemicals—organic chemicals, metals and inorganic chemicals created by humans through chemical processes—play a role in nearly all forms of productive activity; they constitute the material base of society and are involved in some way with nearly every aspect of life. For these reasons, the *properties* of chemicals—particularly their toxicity and ecotoxicity—are of great public significance.

THE PROPERTIES THAT MAKE SYNTHETIC CHEMICALS USEFUL TO SOCIETY CAN ALSO MAKE THEM HAZARDOUS TO HUMAN BIOLOGY AND ECOLOGICAL PROCESSES

There is ongoing scientific concern over the biological implications of chemical exposures that occur over the course of the human life span—in workplaces, homes and the ambient environment—particularly during the sensitive period of fetal and child development. It has become apparent that many synthetic chemicals persist in the environment and accumulate in human tissues. One group of brominated flame retardant chemicals, for example, showed a doubling time in human milk of only five years. The extent to which bioaccumulative substances disrupt biological processes is still largely unknown; however, a 2005 study reported that fetal exposure to a class of chemicals used in a variety of consumer products—a class of common chemical plasticizers—known as phthalates—were the likely cause of statistically significant changes in the sexual characteristics of a study group of 134 boys aged 2 to 36 months.[8] These changes were consistent with those seen in animal studies and were reported to occur at maternal phthalate blood levels below those found in one-quarter of the female population of the U.S. This study will need to be replicated; it is conceivable, however, that the reported effects represent one outcome in a cascade of other, as yet unidentified, forms of endocrine disruption.

There is a substantial body of literature regarding chemically induced diseases among workers and other highly exposed individuals and populations. Some portion of the 35,000 new cases of occupationally related disease diagnosed each year in California (excluding musculoskeletal disorders) are related to chemical exposures, as is some portion of the 4 to 10 percent of cancer deaths and 10 to 20 percent of deaths resulting from chronic obstructive pulmonary disease (COPD) that are attributed to occupation.[9]

For a variety of reasons, however, the true burden of chemically induced disease is unknown. Board-certified occupational physicians, for example, constitute only about 0.2 percent of U.S. physicians, and only half of U.S. medical schools require an average of six hours of instruction in occupational medicine.[10, 11] The full scope of health effects associated with the great majority of chemicals in commercial circulation, even as isolated entities, are unknown. The drop in union density—now less than 10 percent in the U.S. private sector—has likely produced a decline in vigilance among workers with respect to work-related diseases, particularly among low-income, minority and immigrant workers, who are at greatest risk.[12] As noted below, there are still wide gaps in government protections for worker health and safety.

U.S. AND CALIFORNIA CHEMICAL REGULATORY APPROACHES ARE IN NEED OF MODERNIZATION

Development in scientific understanding of chemical toxicity and ecotoxicity has far outpaced government and public oversight of the 81,600 chemicals in commercial circulation—and the 2,000 new chemicals introduced in the U.S. each year—as listed in the inventory of the federal Toxic Substances Control Act (TSCA).[4] The scope of U.S. and California chemical statutes remains surprisingly limited. Together, five federal statutes[5] capture only 1,134 chemical substances, or about 3 percent of Class I chemicals in the TSCA inventory.[6] The design and implementation of TSCA has prevented the U.S. EPA from gathering—and distributing—basic toxicity and ecotoxicity information for about 99 percent of chemicals in commercial circulation, by volume.

The U.S. Occupational Safety and Health Administration (OSHA) has adopted workplace exposure limits for only 193, or about 7 percent, of the 2,800 synthetic chemicals produced or imported at more than one million pounds per year in the U.S.; the U.S. EPA reported in 1994, however, that about 16,000 chemicals in commercial circulation are potentially of concern on account of their design and volume in commerce. In September 2005, the California Division of Occupational Safety and Health (DOSH) employed about 200 compliance officers to address worker health and safety matters for the state's nearly 20 million workers.[13, 14] The Hazard Evaluation System and Information Service (HESIS), a California state agency responsible for anticipating and preventing chemical hazards in California workplaces, currently employs three full-time staff members.

Each year, more than $1 billion is spent on cleaning up hazardous waste Superfund sites in the U.S.[15] Assuming current industrial and regulatory practices remain the same, the U.S. EPA expects 217,000 new hazardous waste sites to appear and require mitigation by 2033, on top of a current burden of 77,000 sites. Mitigation is expected to cost about $250 billion. In assessing the top 50 chemicals at hazardous waste sites on the basis of both toxicity and exposure potential, the U.S. Agency for Toxic Substances and Disease

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Registry (ATSDR) reported that 38 (76 percent) are "reasonably anticipated," "possibly" or "probably" capable of causing cancer in humans; 28 (56 percent) are expected to cause developmental defects in children; and 27 (54 percent) are suspected of causing acute and/or chronic neurotoxic effects.

The lack of a strategic, comprehensive federal chemicals policy is adversely affecting California businesses, industry, public health and government.

Constraints on the ability of the federal government to gather and distribute chemical toxicity information—and to assure that the most hazardous chemicals are adequately controlled—has produced fundamental problems for businesses, industry, public health and government in California. It is extremely difficult for downstream businesses and industry to identify the safest chemicals for their operations. Small and medium-sized firms in particular need better information—and technical support—to improve chemical accounting and to evaluate safer chemicals and processes. Each day in California 82,000 tons of chemical consumer and commercial products are sold for which the toxicity is largely unknown. Green chemistry leaders find it difficult to differentiate their products in the market. State agencies do not have the information they need to identify, prioritize and mitigate chemical health risks in the state; as a consequence, during the 2004-2005 legislative session, the California Legislature faced 35 bills pertaining to health and environmental problems with chemicals.

In its present form, chemical regulation in the U.S. and California is experienced by many businesses as a labyrinth of unintegrated rules enforced by a wide array of governmental agencies. There is no single public entity in California, for example, to which businesses can turn for comprehensive information on regulatory requirements or technical support in other aspects of chemicals management. Not surprisingly, while most business and industry leaders in California share universal societal values of healthy working conditions, a clean environment and safe chemical products, they often object to new chemicals policy initiatives in California because they see these in the context of the present regulatory system. At the same time, many business leaders recognize that deficiencies in industrial policy can present a key barrier to new technology investment, including in the design, production and use of chemicals.

THE U.S. CHEMICAL INDUSTRY IS FACING UNPRECEDENTED GLOBAL AND DOMESTIC PRESSURES

A combination of market and regulatory pressures is creating extraordinary challenges for the U.S. and California chemical industry. Producers are facing rapidly rising domestic natural gas costs (with very limited capacity to pass those costs on to global customers), declining availability of nonrenewable petroleum feedstock, ongoing regulatory costs, and a proliferation of state-based chemicals policy initiatives. For the first time historically, the U.S. chemical industry is operating with a global trade deficit. The European Union is implementing far-reaching chemical regulatory policies that will significantly affect U.S. producers, as well as the global chemicals market. Some large downstream users of chemicals in the health care and consumer products sectors are implementing purchasing regimes that include criteria to screenout the use of certain classes of chemicals. These firms include Kaiser Permanente, the largest private-sector employer in the San Francisco Bay Area and the largest private health care provider in the U.S.

The U.S. chemical industry recognizes the three pillars of economic, environmental and social sustainability represent the long-term answer to these challenges. The websites of the top 50 U.S. chemical companies all contain a statement of commitment to achieving sustainability goals. At the same time, however, spending on research and development by the top 50 firms has decreased or remained flat since about 2000,[16] and there are no indications of substantive federal leadership to advance a long-range, comprehensive plan to support the viability and competitive position of the U.S. chemical industry.

CALIFORNIA HAS AN OPPORTUNITY FOR LEADERSHIP IN CHEMICALS POLICY

It is not surprising, therefore, that the Committee on Grand Challenges for Sustainability in the Chemical Industry, convened by the National Academy of Sciences, concluded in its December 2005 report that in "going forward, the chemical industry is faced with a major conundrum—the need to be sustainable (balanced economically, environmentally, and socially in order to not undermine the natural systems on which it depends)—and a lack of a more coordinated effort to generate the science and technology to make it all possible."[17] The committee included academic scientists as well as representatives from Dow, PPG Industries, ConocoPhillips and Agraquest, Inc.

The committee's findings echo those of a 2003 study by Rand, which identified four key barriers to the development and implementation of green chemistry and engineering principles in the U.S.:[18]

1) Lack of research, technology development and new process engineering;

2) Industrial infrastructure problems and integration barriers;

3) Up-front investments required; and

4) Lack of coordinated actions by means of regulations, incentives and government purchasing.

Clearly, given the importance of the chemical industry, the pressures facing U.S. producers warrant a concerted policy response. California has a unique opportunity to consider chemicals policies that would support and motivate U.S. chemical industry leaders to expand their investments in green chemistry technologies within the state of California.

This will require a comprehensive approach that employs both incentives and regulatory tools to meet four overarching chemicals policy goals:

(1) Reward chemical producers, distributors and end users to invest in best practices and environmental stewardship.

(2) Reward investment in a broadly defined set of green chemistry and sustainability, initiatives, such as:

a. implementing life cycle analyses of products;

b. providing robust, standardized

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chemical toxicity and ecotoxicity information to downstream users;

c. introducing cleaner chemical processes;

d. designing chemical products that are inherently compatible with biology;

e. using renewable chemical feedstocks and renewable fuels;

f. reducing energy intensity of processing;

g. separating, sequestering and utilizing carbon dioxide; and or

h. advancing green chemistry and sustainability education and research.

(3) Implement measures to improve the flow of chemical toxicity, ecotoxicity and other critical data through the supply chain and to appropriate public bodies.

(4) Implement measures to improve the capacity of government to identify, prioritize and reduce genuine chemical hazards in California.

Each of these objectives raises myriad technical questions that will require deliberation by a broad range of stakeholders to resolve. Expertise will be needed particularly from leaders in the chemical industry. This approach, however, is preferable to the reactive environment that currently characterizes chemicals policy decision-making in California, particularly with regard to the legislative process.

Given the critical role of the chemical industry in all forms of industrial activity, a thoughtful, comprehensive chemicals policy has the potential to improve long-term productive capacity and employment opportunities in California—while also addressing chemical problems currently facing downstream businesses and industry, public health and government in the state. This approach begins to address the "central conundrum" raised by the National Academy of Sciences, and in the long run it could provide the framework for rebuilding U.S. competitiveness in chemicals. Clearly, chemicals policy is central to California's future and the extent to which it emerges along lines that are economically, environmentally and socially sustainable.

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FOOTNOTES:

[1] These include the E.U. *Waste Electrical and Electronic Equipment* (WEEE) Directive, the

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Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS) and the *Registration, Evaluation and Authorization of Chemicals* (REACH) initiative.

[2] Assuming separate nation states of the European Union.

[3] Includes producers of basic chemicals, specialty chemicals, consumer products, pharmaceuticals and pesticides.

[4] According to the American Chemistry Council, there are about 9,000 chemicals in the inventory that are currently produced or imported at more than 10 tons per year.

[5] These are the Clean Air Act (1970), the Occupational Safety and Health Act (1970), the Clean Water Act (1972), Resource Conservation and Recovery Act (1976) and the Emergency Planning and Community Right-to-Know Act (Toxics Release Inventory) (1994).

[6] TSCA Class I chemicals are considered to be discrete chemicals with a definite structure.

The Real Rx

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role models for these healthy behaviors.

Take your knowledge and influence into the community. Some physicians, like Redding's Dr. Ron Reece, have become politically active in city planning and development. Reece's involvement has created a buzz around Redding's Open Parks and Trails Vision, a proposal to get people out of their cars and into their communities. This plan would fund open space and trails, enable children to safely walk or bike to school, and establish other healthy guidelines for development. Some of your patients are influential community leaders: mayors, city managers and school board members. Some are schoolteachers and PTA members. They can contribute to healthy, well-planned communities with parks, sports fields, farmers' markets and good public transportation.

We Americans love our independence, but we also crave more choice. We need healthier choices to be healthier people. And yes, we physicians will continue to treat the patient. But healing our population begins with healing the environment.

Dr. Richard Jackson is a pediatrician and public health officer who has held many positions in the California Department of Health Services including state health officer. He was also center director for Environmental Health at the CDC in Atlanta for 10 years. Ms. Doshi was an executive fellow and Ms. Rai was a graduate assistant when this article was written.

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Some Educational Resources Online

For peer-reviwed resources on specific diseases and contaminants, see the Collaborative on Health and the Environment:www.healthand-environment.org.

GREATER BOSTON PHYSICIANS FOR SOCIAL RESPONSIBILITY: IN HARM'S WAY: TOXIC THREATS TO CHILD DEVELOPMENT
http://psr.igc.org/ihw-project.htm

PEDIATRIC ENVIRONMENTAL HEALTH TOOLKIT
http://psr.igc.org/ped-toolkit-project.htm

ENVIRONMENTAL HEALTH IN FAMILY MEDICINE: CURRICULUM FOR TEACHING AND LEARNING ENVIRONMENTAL HEALTH, 2001
Written by physicians and environmental health specialists for health care professionals working with children and family medicine. Module topics cover lead, indoor and outdoor air quality, pesticides, water quality and persistent organic pollutants (POPS). 167 pages. Free. Download at http://www.ijc.org/rel/boards/hptf/modules/content.html

HANDBOOK OF PEDIATRIC ENVIRONMENTAL HEALTH
Ruth A. Etzel, ed.
American Academy of Pediatrics. Discusses preventable environmental hazards, including tobacco, ultraviolet light, water pollution, pesticides, lead and mercury. Addresses issues such as nitrates in water, asthma triggers and food contamination and identifies specific settings in which children might be exposed to environmental hazards. Contact American Academy of Pediatrics, http://www.aap.org/bst/showdetl.cfm?&DID=15&Product_ID=1697

ONTARIO COLLEGE OF FAMILY PHYSICIANS HEALTH EFFECTS OF PESTICIDE ANALYSIS
http://www.ocfp.on.ca/English/OCFP/Communications/CurrentIssues/Pesticides/default.asp?s=1

Our Stolen Future: A Decade Later

John Peterson Myers, PhD, Dianne Dumanoski and Theo Colborn, PhD

Who would have predicted ten years ago that:

- An environmental contaminant, bisphenol A, would cause insulin resistance in adult mice after only four days' exposure[1] at concentration levels comparable to that found in tissue and fluid of virtually every American tested by the Centers for Disease Control?[4]
- Or that this same molecule is equipotent with estradiol at stimulating calcium influx and prolactin release in pituitary tumor cells in vitro, in concentrations of less than one part per billion.[18] (Increasing calcium can initiate signaling cascades that lead to a variety of cellular changes.)
- Or that the gene that produces amyloid precursor protein—a protein implicated in Alzheimer's disease—would be upregulated during old age in mice after behaving normally throughout most of the animal's life, following perinatal exposure to environmentally-relevant levels of lead? And that the same lead exposure in adulthood has no comparable effect?[2]

We published *Our Stolen Future* in 1996, drawing widespread attention to the scientific discovery that low doses of some contaminants can interfere with hormonal signaling, thereby altering fetal development.

When we wrote *Our Stolen Future*, there was strong evidence from laboratory animals and from studies of wildlife, but few studies to test for effects in people that the animal research predicted could be happening. The issues raised by the animal research were so serious that governments in Asia, North America and Europe over the next decade invested hundreds of millions of dollars in research on endocrine disrupting chemicals (EDCs) in the environment.

In the aftermath of those research investments, new scientific discoveries like those described above are now flooding into the scientific literature.[8] Thousands of scientists have become engaged in research on endocrine disruption, from university and government laboratories around the world, and thousands of research papers have been published. The laboratory studies of animals and mechanistic studies using cell culture strongly confirm the scientific results we reviewed in *Our Stolen Future* and raise many additional concerns that were not perceived just 10 years ago. And some human studies are now finding patterns consistent with the predictions that we made based on animal research.

Taken together, these studies are the building blocks of a scientific revolution, with profound implications for public health. There are many elements to this revolution:

- Very low doses of some contaminants can alter hormone signaling and, by doing that, alter gene expression. These changes can have wide-ranging impacts upon development; the specific effects will depend upon gene, tissue and timing of exposure.[7, 15, 19]
- The range of hormonal signaling systems vulnerable to endocrine disruption has been widened dramatically, well beyond the initial focus on steroid hormones such as estrogen. Every component of the endocrine system that has been studied carefully has been shown to be affected. Specific contaminants are known to alter signaling pathways controlled by estrogens, androgens, glucocorticoids, thyroid, progesterone, insulin and retinoids.
- Recent research has also demonstrated that a new class of receptors associated with cell membranes can be disrupted by estrogenic contaminants. This has been especially important because several of the contaminant molecules studied, like bisphenol A, are just as powerful as estradiol (a natural form of human estrogen) at changing cell signaling via this pathway.[9, 18] In this context, these contaminants are not just weak estrogens, as critics of endocrine disruption have asserted; they are equally as powerful as endogenous estradiol and estrogenic drugs.
- A recurring pattern in animal and cell research is dose-response curves that are non-monotonic, that is, shaped like a U or an inverted U. These demonstrate that

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low doses can have qualitatively different effects than high doses, and that the low dose effects cannot be predicted on the basis of high dose results.[17]

- The range of health end points of concern has broadened dramatically beyond the initial focus on reproduction and infertility. Intellectual development, behavior, disease resistance, autoimmune disease and even weight regulation (obesity) are now areas of research on the impacts of EDCs.
- It had traditionally been thought that one contaminant was likely to influence a relatively small number of health end points, for example, the ability of asbestos to cause meso-thelioma. This is now clearly a false assumption. Because some endocrine disrupting compounds affect the expression of a wide array of genes, it would not be unexpected to see them emerge as causal agents in disease end points that are associated by human genetic studies with those genes. Research with bisphenol A, for example, shows this compound alters the expression of many different genes involved in multiple biochemical pathways.[12] Genetic research has established links between some of those genes and a wide array of human health problems, including infertility, behavioral abnormalities, memory problems, senility and obesity.
- Fetal development is the most vulnerable period of life, and impacts on the fetus can cause effects all through life, with the effects sometimes not visible until adulthood. A new field of research has emerged, called fetal origins of adult disease. Testicular cancer is one example, where hormonal imbalances in the womb appear to cause abnormal development of cells within the fetal testes. These abnormal cells then become cancerous in adulthood.
- Mounting evidence indicates that testicular cancer is one part of a syndrome of male reproductive disorders in people called testicular dysgenesis syndrome (TDS).[11] Other elements of TDS are reduced sperm quality, undescended testes and hypospadias. Animal experiments show close parallels with a syndrome that can be produced in laboratory experiments by exposing fetal male rodents to a class of plasticizers call phthalates, which suppress testos-terone synthesis and interfere with genes involved in testicular descent in fetuses. Recent epidemiological work confirms associations in baby boys with phthalate exposure in the womb, using techniques designed explicitly to test predictions in people based on results from animals.[14]
- Chemical mixtures of environmental hormones are ubiquitous, and they have greater impacts than single contaminants. Several careful laboratory studies show that mixtures of contaminants, each at concentrations where they individually cause no detectable effect, in combination cause large effects.[10,3] These experiments, conducted typically with up to a dozen contaminants simultaneously, have begun to explore what it may mean for people to be exposed simultaneously to hundreds of chemicals. For example, a recent study tested human umbilical cord blood for contaminants and found 287 chemicals of the 413 contaminants that were measured.[5]

One of the most important implications of the laboratory studies has been that most human studies into the effects of environmental hormones have been conducted in ways that weaken their ability to find effects. Few epidemiological studies incorporate the scientific points summarized above, especially: possible effects of fetal exposures on adult diseases; simultaneous exposures to many different chemicals; and effects at low levels of exposure differing qualitatively from effects at high levels. They also usually ignore human and animal data showing large differences within populations in sensitivity to exposure, a failure that further weakens the power of epidemiological research. Because of these and other study design failures, it is highly likely that the epidemiological literature is full of what statisticians call false negatives: concluding a compound is safe when it really is not safe. Insisting that there be conclusive evidence from human studies before taking regulatory action is highly likely to be putting people at risk.

Some epidemiologists are responding to this challenge by changing their study designs to reflect the advances in animal science. These new studies are beginning to show strong effects in people.[13,14]

One disturbing pattern that has emerged in these studies is that the source of funding is associated with the likelihood of finding adverse effects.[6,16,17] Work funded by industry is much less likely to report adverse impacts compared to that funded by government. This pattern has been reported in scientific studies across a wide array of economic sectors, not just the chemical industry.

While these scientific results raise questions about the safety of many products in widespread use today, they are also a source of hope. They point toward a future in which steps to reduce exposures may help prevent diseases that until recently many may have never imagined were preventable.

Theo Colborn, John Peterson Myers and Dianne Dumanoski coauthored Our Stolen Future, *first published in 1996, the book that first brought widespread attention to the ability of some contaminants to interfere with hormone signaling. Dr. Myers is chief scientist for Environmental Health Sciences, based in Charlottesville VA. He chairs the board of the National Environmental Trust and the Science Communication Network. Dr. Colborn is president of The Endocrine Exchange, or TEDX, located in Paonia, Colorado, and professor of the Department of Zoology, University of Florida, Gainesville. Dr. Colborn has received numerous awards, including the Blue Planet Prize, for her work on endocrine disruption. Ms. Dumanoski is a noted environmental reporter, with many years covering the environmental beat for the* Boston Globe. *She is now writing a book about human prospects and the emerging environmental crisis.*

For a copy of the references for this article email the managing editor at ecarroll-@sfms.org.

The new SFMS Website is currently under construction. Please excuse any inconvenience as we continue to update all information. The site can be accessed at www.sfms.org.

Biomonitoring: Measuring Environmental Contaminants in the Body

Davis Baltz, MS

Biomonitoring studies demonstrate without doubt that everyone, no matter where they live or what they do for a living, is exposed to environmental chemicals. To health advocates, what we are learning about exposure to chemicals in the environment is a good reason to gather more data to support policies that reduce exposure, while acknowledging that biomonitoring by itself is not a predictor of disease or indicative of an exposure pathway.

Biomonitoring, or biological monitoring, is the actual measurement of environmental chemicals in the body. It has frequently been in the news over the past year as interest in its public health applications rises. Advances in analytical laboratory techniques are making it possible to test for more chemicals at lower concentrations. Chemicals can be detected in a growing number of biospecimens, including blood, urine, hair, bone, umbilical cord blood, breast milk and meconium.

Significantly, because of the growing number of health conditions now linked by peer-reviewed research to exposure to environmental contaminants,[1] biomonitoring studies are emerging as important new tools for public health and medical professionals, as well as for community-based groups interested in environmental health advocacy, community safety and environmental justice. Evidence is mounting that environmental factors likely play a role in the rise in chronic and acute diseases such as asthma, autism, developmental and learning disabilities, Parkinson's disease, and hormonally mediated cancers that affect increasing numbers of families around the globe. This in turn is stimulating profound policy discussions about how chemicals and their risks should be managed.

WHAT HAVE WE LEARNED FROM BIOMONITORING?

Biomonitoring is not a new technology. Blood lead levels have been measured for many years, for example, producing data that provided the impetus to ban lead from gasoline and paint. These developments have indisputably improved health by lowering exposure, especially for children. Similarly, the prevalence of Breathalyzer tests to determine exposure to alcohol is a common and long-standing practice that measures a chemical in the body.

What can biomonitoring tell us? There are several valuable uses: it closes gaps in exposure data and helps establish trends in chemical exposure; identifies particularly exposed or vulnerable communities; expands biomedical, epidemiological and behavioral public health research; assesses the effectiveness of current regulations; sets priorities for legislative and regulatory action; and informs first responses to emergencies. We can expect biomonitoring to be used increasingly often as lab costs drop in the future.

Beginning in 2001, the Centers for Disease Control and Prevention (CDC) has published biennial "National Reports on Human Exposure to Environmental Chemicals," using data collected under the National Health and Nutrition Examination Survey (NHANES). The first report in 2001 documented the presence of 27 chemicals in the blood and urine of a cross section of Americans throughout the U.S. The 2003 report examined 116 chemicals, and the most recent report, released in July 2005, further expanded the list to 148 chemicals. Subsequent studies will report on approximately 310 chemicals in 2007 and 475 chemicals in 2009.

The CDC reports are important because they signal attention at the federal level for biomonitoring data. The 2003 study[2] found that Mexican Americans had three times the levels of the metabolite of the insecticide DDT (DDE) as other participants, despite the fact that DDT has been banned in the United States for over 30 years. The study also found that children had twice the level of the pesticide chlorpyrifos as adults did. These kinds of findings are both startling and useful for many researchers, policy makers, and advocates.

Among the findings of CDC's 2005 report[3] is the continued decline of exposure to lead among children, as 1.6 percent of children had measured blood lead levels above 10 micrograms/deciliter. By contrast, in the late 1970s, 88.2 percent of children had levels above this same threshold of 10 micrograms/deciliter. This stunning reduction can be traced

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to the elimination of lead from gasoline, and demonstrates biomonitoring's value both in establishing exposure trends and as a policy driver to reduce exposure.

Other studies have confirmed the particular vulnerability of certain populations to chemical exposure, such as the young child and fetus. A July 2005 report by the Environmental Working Group[4] tested umbilical cord blood samples for a total of 413 chemicals and found an average of 200 per sample, including pesticides, consumer product ingredients and wastes from burning coal, garbage and gasoline. If there was any question that the placenta might be an impervious barrier for environmental contaminants, this study demolishes the notion.

A study mounted by Commonweal in 2005[5] biomonitored a dozen prominent Californians and gave them the chance to speak about their personal reactions. The study was released while the California Legislature was considering Senate Bill 600, the "Healthy Californians Biomonitoring Program." The bill would have created the nation's first statewide biomonitoring program to measure environmental contaminants in state residents. It attracted broad support from medical, public health, scientific, environmental and community health advocates, including the California Medical Association. The California Legislature passed the bill, but Governor Schwarzenegger subsequently vetoed it.

IMPLICATIONS FOR CHEMICALS POLICY

Biomonitoring studies have clearly established that every population worldwide is exposed to some mixture of chemicals in the environment. The cord blood study cited above found an average of 200 chemicals contaminating the womb before the mother gave birth. These high numbers are alarming, and yet consider that labs today can only detect approximately 600 chemicals in human biospecimens.

By contrast, there are some 80,000 industrial chemicals registered for use in the United States, with an additional 1,000 to 2,000 new chemicals added every year. Despite the grave concern we rightly have for many of the substances we are finding in the human body, we are only able to look for less than 1 percent of the total to which we may be exposed.

Beyond this, we have a shocking dearth of safety information about chemicals already in use. It comes as a disturbing surprise to people to learn that most chemicals are essentially untested before entering the marketplace.

Nearly all the synthetic chemicals now ubiquitous in the environment have been developed and disseminated worldwide over the past 60 years. They simply did not exist until the explosion of the petrochemical industry in the aftermath of World War II, much of it sited on the U.S. Gulf Coast.

The only federal law that regulates industrial chemicals, the Toxic Substances Control Act (TSCA), is utterly inadequate to test chemicals for toxicity before approval.

Of the 62,000 chemicals in existence when TSCA was enacted in 1977, only 2 percent have been fully examined by the EPA. Of the 18,000 introduced since that time, no health data have been provided to EPA for 85 percent. Some 65 percent of new chemical submissions submitted to the EPA by industry are claimed as "confidential business information" and hence do not include safety testing information. Of greatest concern are the 2,800 high-volume chemicals produced in volumes of more than 1 million pounds per year. These compounds are widely dispersed in homes, schools, communities, consumer products and the environment. Fewer than 20 percent have been tested for their potential to cause developmental toxicity. Absence of this information makes risk assessment impossible and prevention difficult. Absence of testing is not absence of harm.[6]

The critical take-home message is that we need systematic, comprehensive data gathering programs so the extent of exposure can be more fully understood and the relative safety of chemicals can be better assessed before widespread exposure occurs.

CONCLUSION

Biomonitoring studies, by offering definitive proof of exposure, demonstrate the disquieting truth that all people, including the developing child in the womb and the infant, carry toxic chemicals in their bodies that may be impairing their ability to fully achieve physical health and intellectual development. We all carry a chemical body burden that has been imposed without our knowledge, much less our consent.

How can we ensure that the right to be born free of toxic chemicals is provided to all? To begin, we need to recognize our ignorance and require that chemicals be comprehensively tested before they are introduced into commerce, the wider environment, and our bodies.

Biomonitoring is a credible scientific tool that has an important role to play in the fight against disease. We monitor our air, our water, our soil and even our fish to learn which chemicals are polluting the environment. Biomonitoring offers the opportunity to actually measure these same levels of pollution in people. These important data provide the scientific evidence needed for a paradigm shift toward more precautionary chemicals management.

Davis Baltz, MS, is special project advisor for the Collaborative on Health and the Environment and serves as a senior program associate at Commonweal for the measurement of chemicals in the human body. He is a cofounder of Health Care Without Harm and the Bay Area Working Group on the Precautionary Principle and was a 2004 Mesa Refuge fellow.

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1. See the Collaborative on Health and the Environment for peer-reviewed papers and database summarizing the links between environmental contaminants and disease. http://www.healthandenvironment.org/science/peer_reviewed.

2. The data from CDC's Second National Report on Human Exposure to Environmental Chemicals (2003) was incorporated into the Third Report. http://www.cdc.gov/exposure-report/.

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Toxicants and Disease Database Update

Sarah Jannsen, MD, PhD, MPH

A second edition of the Collaborative on Health and the Environment's (CHE) "Toxicants and Disease Database" has been made available in a web-based format at http://database.healthand-environment.org/. The newly updated database summarizes associations between primarily chemical contaminants and approximately 180 human diseases or conditions. While it is not a comprehensive or exhaustive review of all toxicants and diseases, the database does reflect the most up-to-date science on their associations.

The database is searchable by toxicant, disease category or individual disease. Each disease or condition is listed with associated toxicants, grouped by strength of evidence. The groupings of "strong," "good," or "limited/conflicting" evidence are easily recognized by color-coding. The new format also allows for searching by individual toxicants, chemicals or exposures.

The "strong evidence" category is reserved for toxicants where a causal association with disease has been verified and is well accepted by the medical community. For example, agents listed as Group 1 human carcinogens by the International Agency for Research on Cancer (IARC) are in this category. Other chemicals are drawn from recent prospective or retrospective cohort studies.

The "good evidence" category includes toxicants associated with a disease through smaller epidemiological studies (cross-sectional, case-series, or case-control studies). Toxicants such as IARC Group 2A chemicals, those with limited evidence for causing cancer in humans and sufficient evidence in animals, also are included in this category.

The "limited/conflicting evidence" category contains toxicants weakly associated with human disease by case reports, from conflicting human epidemiological studies with mixed or equivocal results or, in a few cases, from animal data with no human data existing. Also included in this category are chemicals that show limited or inadequate evidence of causing cancer in people and limited animal evidence of causing cancer.

As more scientific research is done, some toxicants in the database may be deemed to show stronger evidence for causing disease, new toxicants may be added, and others may be found to have no association with a disease and fall off the list entirely.

This database has significant limitations that are important to keep in mind.

1. Agents listed are a representation of toxicants that contribute to human disease. This is not an exhaustive or comprehensive list and includes primarily chemicals and diseases found in major textbooks and medical literature reviews.
2. The database does not address the route, timing, duration or amount of exposure required to result in a particular condition. Some toxicants may only be harmful if inhaled, whereas others need to be ingested in order to cause harm. Some diseases result from only high dose exposures, whereas low-level exposures may be safe. Moreover, variations in the susceptibility to toxic effects, depending on the timing and duration of exposure, are not addressed. For example, a fetus or developing child is often more susceptible than an adult. For details such as the dose, timing, duration and route of exposure, the reader is referred to the textbooks, references and the attached online links in the database.
3. The database makes no attempt to quantify the proportion of disease caused by a specific toxicant. For example, mesothelioma, a rare form of cancer, stems almost entirely from exposure to asbestos. In contrast, the proportion of lung cancer cases caused by asbestos exposure is relatively small compared to the number of cases caused by tobacco smoking or radon.
4. Finally, this is a work in progress. In many cases, the authors exercised judgment when considering the strength and categorization of evidence.

Comments from readers are welcome and should be sent to Sarah Janssen at sjanssen69@yahoo.com.

Sarah Janssen received her MD and her PhD in physiology from the University of Illinois, Urbana-Champaign. She recently completed her MPH as part of her training in the Occupational and Environmental Medicine residency program at the University of California, San Francisco. Sarah is one of three authors of the CHE Toxicants and Disease Database. Her coauthors are Gina Solomon, MD, MPH, and Ted Schettler, MD, MPH.

Green Guidelines for Health Care

Charlotte Brody, RN

Health Care Without Harm, in partnership with Healthy Building Network and the Center for Maximum Potential Building Systems, has developed a new tool for health care construction called the Green Guide for Health Care (GGHC). This is the first ever metric guidance tool for health professionals, architects and designers. Formally released in November 2004, the GGHC has already received the endorsement of Hospitals for a Healthy Environment (which includes the U.S. EPA, the American Hospital Association, the American Nurses Association and HCWH), Kaiser Permanente, Brigham and Women's Hospital, Ascension Healthcare and other major systems nationwide. Moreover, in just the last five months, 25 hospitals have agreed to pilot the GGHC. The Green Guidelines for Health Care are available for viewing and downloading at www.gghc.org.

CLEAN MED IN SEATTLE

On April 19 and 20, 2006, Health Care Without Harm will host the fourth U.S. Clean Med Conference. Clean Med is the premier national conference for environmental leaders in health care. The agenda for 2006 includes a preconference workshop on green building (April 18, 2006); design and operation of green buildings; environmentally preferable products for health care; reducing waste and toxicity and ensuring healthy food in health care.

The keynote speakers for Clean Med 2006 are leaders in defining emerging environmental problems and promoting safer alternatives. Tyrone B. Hayes, PhD, and Paul Hawken will be presenting. For more information go to www.cleanmed.org.

ELECTRONICS

HCWH is working with the Computer Take Back Campaign and with the nation's largest Group Purchasing Organizations for health care to require manufacturers to offer computers without lead, brominated flame retardants, cadmium and other toxic inputs. In the last year, Kaiser, Catholic Healthcare West and many other systems have adopted a recycling pledge to ensure that their used electronics equipment is responsibly recycled using credible companies.

GLOBAL MERCURY-FREE AND DIOXIN-FREE MEDICINE

HCWH has initiated the second stage of a project with the World Health Organization and the United Nations to develop model programs in seven countries to eliminate mercury and dioxin from the health care sector. In the U.S., 95 percent of pharmacy chains have stopped selling thermometers that contain mercury. A similarly dramatic phase-out of syphygmomanometers with mercury is expected within the next two years.

HEALTHY FOOD IN HEALTH CARE

In November 2005 HCWH, Kaiser Permanente (KP) and Catholic Healthcare West (CHW) hosted the first-ever FoodMed, a one-day conference in Oakland. FoodMed was designed to help its target audience of hospital food service managers to incorporate sustainable and nutritious food purchasing at their facilities and learn cost-effective strategies that emphasize health concerns that meet the unique needs of the health care systems. Health Care Without Harm is working with Kaiser Permanente to develop a comprehensive food policy that supports sustainable agriculture and locally sourced organic food. KP has 25 different hospitals in its systems using farmers' markets and is working with HCWH to implement a farm-to-hospital purchasing program for organic food.

PVC ELIMINATION

In November 2005, Catholic Healthcare West awarded a new $70 million contract for PVC/DEHP-free IV bags and tubing to B. Braun. Dioxin is released when PVC plastic is produced and when it is incinerated after use. Unlike most other plastics, PVC is brittle and must have plasticizers added to it to make it soft, clear and pliable. The phthalate DEHP is the plasticizer used in PVC medical products. DEHP is a reproductive toxin.

In its press release, CHW noted that it is the first major integrated delivery network to take such a strong position on the use of PVC/DEHP-free products. The CHW decision adds to the significant movement away from PVC and DEHP in health care, following the FDA public health notification on PVC with DEHP. Recently Consorta (which buys for 480 Catholic hospitals) collaborated with HCWH to make a decision to adopt a PVC-free flooring contract for its entire system. KP also expanded

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Methylmercury in Fish: An Update

Jane M. Hightower, MD

The methylmercury-in-fish debate continues to show that the economics of industry and the health of the consumer are at odds. Despite this, the AMA passed a resolution recognizing methylmercury as a hazard in food in 2004.

The coal mining industry (coal has mercury in it), the power companies that burn the coal and release mercury into the air, the fishing industry that sells fish containing significant mercury content, the food companies that sell canned tuna and other fish products, and the restaurants and grocery stores that sell fish—all have economic interests in this issue.

For over 25 years, some in these industries paid to have studies conducted, concluding that mercury is not a health concern. Bias there is now in question, as fishing personnel and their family members were used as study subjects in these industry-funded studies.

Adverse effects from mercury have been reported in many controlled studies not funded by industry. In infants and children, mercury has been correlated with damage to the developing fetal brain and autonomic system. For adults, methylmercury has been correlated with adverse neuropsychiatric effects, male infertility, autoantibodies and subjective complaints. The issue of most concern is that there appears to be a threshold at which methylmercury will increase atherosclerosis, canceling out the good effects of omega-3 fatty acids.

As of November 2005, the California Attorney General and the tuna industry are in court arguing the state's right under Proposition 65 to place mercury warnings on labels of canned tuna. This will allow the consumer ready access to the FDA methylmercury advisory through a Prop. 65 warning. Although the wording for the Prop. 65 warning is the same as the FDA advisory, the tuna industry's argument against it is that the Prop. 65 warning is not within the FDA guidelines, as the FDA does not require warnings at the point of sale.

Dr. Hightower is an internist in San Francisco and a member of the SFMS Board of Directors.

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Green Guidelines for Health Care

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the market for PVC-free carpets when it persuaded Collins & Aikman to develop and introduce an entirely new PVC-free carpet called Ethos.

Charlotte Brody is a registered nurse. She is the executive director of Commonweal, a 30-year-old health and environmental research and education institute in Bolinas, California. She is also a founder and former executive director of Health Care Without Harm. Health Care Without Harm is an international coalition of 431 organizations in 52 countries working to transform the health care industry so it is no longer a source of harm to people and the environment. The mother of two sons, Charlotte also serves on the boards of Smith Farm and the Environmental Working Group, the Advisory Boards of the Environmental Health Strategy Center and the Environmental Stewardship Council of Kaiser Permanente and the Steering Committee of the Safe Cosmetics Campaign.

Biomonitoring Contaminants

Continued from page 35

3. http://www.cdc.gov/exposurereport/.

4. http://www.ewg.org/reports/bodyburden2/ The Environmental Working Group has also conducted a study of flame retardants found in breast milk, highlighting unsafe exposures for newborns to industrial chemicals: http://www.ewg.org/reports/bodyburden.

5. The Commonweal report "Taking It All In" is available at: http://www.commonweal.org/programs/brc/Taking_It_All_In.html.

6. Comments to ABC News by Philip Landrigan, MD, of Mount Sinai School of Medicine concerning the EWG cord blood study, July 14, 2005

2005 SFMS Election Results

2006 OFFICERS

(one-year term):

President-Elect: Stephen E. Follansbee, MD
Secretary: Charles J. Wibbelsman, MD
Treasurer: Steven H. Fugaro, MD
Editor: Mike Denney, MD

BOARD OF DIRECTORS

(seven elected for three-year term 2006-2008):
Mei-Ling E. Fong, MD
Thomas H. Lee, MD
Carolyn D. Mar, MD
Rodman S. Rogers, MD
John B. Sikorski, MD
Peter W. Sullivan, MD
John I. Umekubo, MD

NOMINATIONS COMMITTEE

(four elected for two-year term 2006-2007):
Kenneth J. Hammerman, MD
Richard M. Naidus, MD
Daniel M. Raybin, MD
Charles J. Wibbelsman, MD

AMERICAN MEDICAL ASSOCIATION DELEGATE

(two-year term 2006-2007):
H. Hugh Vincent, MD

AMERICAN MEDICAL ASSOCIATION ALTERNATE

(two-year term 2006-2007):
Judith L. Mates, MD

CALIFORNIA MEDICAL ASSOCIATION TRUSTEE

(two-year term 2006-2008):
Robert J. Margolin, MD

YOUNG PHYSICIANS SECTION DELEGATE

(two-year term 2006-2007):
Jordan Shlain, MD

YOUNG PHYSICIANS SECTION ALTERNATE

(two-year term 2006-2007):
Lily M. Tan, MD

DELEGATES TO THE CMA HOUSE OF DELEGATES

(First five are delegates; next six are alternates; Stephen E. Follansbee, president-elect, will serve as the sixth delegate according to the SFMS bylaws) for a two-year term 2006-2007:

Delegates:
Alan G. Greenwald, MD
Brian J. Lewis, MD
Dexter Louie, MD
Judith L. Mates, MD
George P. Susens, MD

Alternates:
Lucy S. Crain, MD
Carolyn D. Mar, MD
Rita Melkonian, MD
Rachel Hui-Chung Shu, MD
Peter W. Sullivan, MD
John I. Umekubo, MD

Congratulations to all those who were elected and many thanks to all who participated.

We're Moving! The mansion at 1409 Sutter Street has been sold and the administrative offices of the San Francisco Medical Society are in the process of moving to our new headquarters as we go to press. Our new offices (shown above) will be located in the Presidio at 1003 A O'Reilly, San Francisco, CA 94129.

HOSPITAL NEWS

Chinese

Fred Hom, MD

CPMC

Damian Augustyn, MD

Kaiser

Bruce Blumberg, MD

The recipient of Chinese Hospital's 32nd Annual Award was Dr. George King, director of research at the Joslin Diabetes Center and professor of medicine at Harvard Medical School. Dr. King lectured on the topic "Designing New Treatments for Diabetes in Asian Americans and All Patients—from Cells to Bedside." Thanks go to Dr. Nick Jew, chair of the continuing education committee, for helping to organize the successful event.

Dr. Roger Eng, chief of radiology, reported that the hospital has entered into a strategic relationship with Kodak to build and demonstrate Kodak's latest integrated digital imaging department. When the department is completed in the first half of 2006, Chinese Hospital will serve as Kodak's showcase site for digital imaging across the western U.S. and Asian markets. In addition, the hospital became the first private hospital in the city to offer a SPECT/CT fusion camera. The CT portion of the machine will allow greater diagnostic accuracy for cardiac nuclear medicine studies. The fused CT image will then allow more precise localization of any abnormal activity in studies such as bone and WBC scans.

This month's JCAHO tip: Surgical or invasive procedure sites must be marked with a check mark in ink or indelible marker.

CPMC has opened a Stroke Care Center. Adults with cerebrovascular disease now have easily accessible expert brain care with David Tong, MD, medical director. The center is staffed by neurological experts specializing in the evaluation and management of individuals with stroke and cerebrovascular diseases, providing comprehensive care to patients whether they have suffered a stroke or transient ischemic attack (TIA) or are at risk for these disorders, helping with disease management and reducing the risk of future events.

The Stroke Care Center provides expert guidance concerning the most appropriate medical and surgical therapies to treat cerebrovascular disorders, as well as preventive therapies to minimize disease and rehabilitation options for those who have suffered a stroke.

Stroke Care Center services include state-of-the-art brain imaging and diagnostic tools, a wide range of disease management and preventive therapies, guidance concerning advanced surgical interventions and treatment options, and a knowledgeable, experienced team of health care professionals. To learn more about the CPMC Stroke Care Center, visit www.cpmc.org/stroke.

Last month CPMC opened a Preregistration and Learning Center at 1825 Sacramento Street. The new facility was designed to streamline the preregistration process for patients scheduled for surgery and other procedures and is equipped to deliver a broad range of services in one location. These services include preregistration online, by phone or in person (most patients are not required to register in person); appointments for those who do need to come in to register, minimizing waiting; and many other services.

Kaiser Permanente San Francisco is committed to supporting the San Francisco Asthma Task Force with technical and financial assistance, as well as leadership. The citywide task force was created in 2001, and has three subcommittees: Schools/Childcare, Environmental and Clinical. The 20-member task force has representatives from public and private health care groups, as well as members representing the school district and child care workers. The task force grew out of a project in the 1990s to control the increase of asthma at George Washington Carver Elementary School in the Bayview Hunters Point area. At the time, the principal of the school noticed an alarming increase in asthmatic episodes among students. Kaiser Permanente provided an asthma education program for staff and students. A community group on asthma education was formed and it grew into the task force. Kaiser San Francisco staff members who have been involved since the early days include Deborah Harper, now an RN Manager of Orthopedics and the Injury Center, Dr. Peg Strub, Chief of KPSF's Allergy Department, and Kathy Thomas-Perry, a community and government relations specialist and former chair of the task force.

Today, the task force conducts many ongoing projects. The clinical committee is working to improve the care and quality of life of children and adults with asthma. Members are working on a project providing asthma education and certification to dozens of health care providers in hospitals and health care groups. A website with links to health care resources for both patients and providers is planned. The Environmental Committee is reducing environmental risk factors for asthma in public housing. Housing inspectors will get training and state-of-the-art cameras to identify sources of moisture in public housing.

HOSPITAL NEWS

Saint Francis

Guido Gores, MD

Saint Francis has been on the move of late—renovating and improving several environments of care. In early December, we hosted the grand opening of our new site for the San Francisco Spine Center. The center has been relocated across the street from the main hospital at the 1199 Bush Street Medical Office Building. With over 5,000 square feet of space, the center can now offer additional services in its comprehensive care model. The upgrade includes space for fluoroscopy-guided injections, digital x-ray and electromylography.

In October, we hosted another grand opening of our new and improved location of our satellite Center for Sports Medicine in Walnut Creek. The center, which originally opened in 1986, has moved to a significantly larger location at 1777 Botelho Drive in Walnut Creek. With a space of 7,000 square feet, the clinic is 57 percent larger than the former complex a few blocks away. The additional space allows for more exam rooms, digital radiology and offices for sports psychology and nutrition.

Here at 900 Hyde Street, construction is underway to complete our new state-of-the-art Emergency Department with a target opening date of October 2006. The new facility will include increased bed capacity, an improved environment for patient privacy and safety, upgraded medical evaluation area, decontamination area and amenities for hospital and EMT staff.

On behalf of my colleagues and the staff of Saint Francis Memorial Hospital let me wish the entire Medical Society a very prosperous and healthy New Year.

St. Luke's

Jerome A. Franz, MD

The boards of St. Luke's and CPMC approved a merger of the two institutions in October. It will be effective when approved by the Attorney General of California, making St. Luke's a fourth campus of CPMC. Our medical staff is getting to know new faces as the administration shuffles in anticipation of the merger.

Dr. Martin Brotman, CEO of CPMC, became CEO of St. Luke's November 1 and brought Grant Davies with him as senior vice president of operations. Dr. Brian Goodell of Navigant will be with us for 90 days as interim chief administrative officer in an effort to implement changes recommended by his consulting firm. Jim Strong, our capable and admired CFO, will continue in that role and also that of director of operations. John Williams has moved to the Sutter corporate office. He deserves much praise for the many improvements seen at St. Luke's during his tenure as CEO.

The new team is committed to strengthening the finances of St. Luke's while maintaining its mission as provider of care to a large underserved population in the South of Market area. Members of the medical staff, under the guidance of Dr. William Miller, chief medical executive, are participating in this process as part of Project Turnaround. We hope to attract new doctors and new patients, who will be pleased by what they find at our jewel of a hospital: dedicated workers, upgraded facilities and a multiethnic patient base that looks to St. Luke's for culturally sensitive, excellent care.

St. Luke's Julie McKown, respiratory therapist, stands out for her extensive outreach to the community. She is the winner of the Ritz E. Heerman Memorial Award for 2005 from the California Hospital Association.

St. Mary's

Kenneth Mills, MD

Last month the FDA approved a new spinal implant invented at St. Mary's. The X STOP is an innovative device and a minimally invasive procedure that offers another option to those suffering from age-related spinal stenosis. Dr. James Zucherman and Dr. Ken Hsu invented the device and St. Mary's will be the training center for this low risk medical procedure. This is an excellent option for patients who fail to improve with conservative therapies, are unable to undergo the risks of major surgery and want to return to functioning pain-free as soon as possible. The financial impact of health care costs as well as lost work hours as a result of back pain is enormous. Typically, the hospital stay for this procedure is less than 24 hours. The procedure can be performed under local anesthesia in about one hour. Prior to approval here, X STOP has been approved and implanted in more than 4,000 patients in Europe and Japan with excellent results. The Spine Center at St. Mary's has been providing comprehensive services for people with spine conditions for over 30 years. The center is composed of both surgical and non-surgical specialists as well as physical therapy and acupuncture.

As San Francisco's oldest community hospital, founded in 1857, St. Mary's Medical Center prides itself on commitment and endurance. One of our favorite celebrations is Employee Recognition and it is always a lively, robust and emotional event. On December 2 our awards ceremony was held at the Marriott Hotel with Brother George Cherrie, our vice president of mission and community services, as master of ceremonies. Employees from all walks of the medical center celebrated anniversaries with family and friends from St. Mary's. An impressively produced video honored employees who had given 25 to 45 years of continuous service.

UCSF

Linda M. Reilly, MD

There has been an explosion of knowledge about Alzheimer's disease recently. Evidence suggests that a protein called beta-amyloid accumulates in the brain in AD and causes brain damage. Early-onset AD leads to dramatic increases in brain amyloid, and transgenic mice that overproduce beta amyloid develop an AD-like syndrome. Many researchers believe that blocking amyloid production, preventing its aggregation, or removing brain amyloid may prevent AD-associated brain damage.

Although there are FDA-approved treatments available, they offer only a transient, symptomatic benefit and do not affect the underlying brain damage. Knowledge about AD has allowed researchers to develop new medications that target amyloid. One approach was a vaccine against amyloid. This vaccine was tried in humans and ultimately failed due to a toxic side effect. Nonetheless, study of patients who received the vaccine suggest this approach may work to clear brain amyloid and improve clinical function.

UCSF Medical Center, under the direction of Dr. Adam Boxer, is currently running a trial of a monoclonal antibody that was designed, based on the vaccine experience, to remove brain amyloid but avoid the toxic side effect. UCSF is the only site in the Bay Area conducting the study. Subjects receive an infusion of the antibody every 13 weeks for 1.5 years. In addition to safety, other outcome measures include neuropsychological tests and caregiver questionnaires. More novel outcome measures are serum and brain beta-amyloid levels, and analysis of brain MRI scans.

This is the first of three planned treatment trials of anti-amyloid therapies at UCSF over the next year. Interested referring physicians, patients or family members should call (415) 476-1681 for more information.

Veterans

Diana Nicoll, MD, PhD, MPA

The San Francisco VA Medical Center (SFVAMC) assesses and treats veterans for medical conditions related to occupational and environmental hazards associated with service in the military. Veterans exposed to specific environmental health hazards (including ionizing radiation from atomic weapons, nuclear submarines and depleted uranium shells, Agent Orange in Vietnam, or pesticides, toxins, desert sand and dust in the Persian Gulf) are entitled to free relevant physical examination, X-rays and laboratory tests and treatment for conditions linked to service-connected exposure.

Environmental medicine database evaluations are electronically linked with the VA's national Environmental medicine registries that provide epidemiologic assessment of medical conditions associated with exposure to military environmental hazards.

The SFVAMC occupies a unique position among the San Francisco health care community—we care for veterans. Some of these veterans, whether young or old, whether they served in Iraq or in World War II, have been exposed and negatively affected by environmental contaminants. Environmental medicine at SFVAMC is responsible for identifying and treating the conditions and diseases manifested by environmental health hazards. Many veterans seeking care for health problems resulting from environmental health hazards are from the Vietnam War era. Diabetes type II, prostate cancer, lung cancer, lymphoma and chronic myelogenous leukemia have been epidemiologically linked to Agent Orange and are presumptive conditions for which veterans may receive financial compensation, medications and health benefits directly from VA or through co-managed care with their community health care providers.

In Memoriam

Nancy Thomson, MD, MPH

ERNESTO J. PULETTI, MD

Dr. Ernesto J. Puletti passed away unexpectedly of a ruptured brain aneurysm, October 8, 2005 at age 73.

He was born in Argentina on January 2, 1932, and was a graduate of the University of Buenos Aires. He trained at the University of San Francisco and practiced internal medicine in the Mission District of San Francisco since 1961, specializing in gastroenterology. He was a member of St. Luke's Hospital staff since 1966 and had served as chief of staff since 2004, having previously served as vice chair. He was also on the staff of Seton Medical Center. He was a member of many medical organizations including the San Francisco Medical Society, the CMA, and the Pan American Medical Society of which he is past president.

Dr. Puletti's passion for medicine and love and dedication to his patients and the community in the Mission were always indicated in his readiness to serve whoever needed him. He was loved by his patients and highly respected by his colleagues. He was a valiant supporter of St. Luke's Hospital and the medical staff, always striving to preserve the mission of providing care for all in need, regardless of their ability to pay. In addition to English, he spoke Spanish, Portuguese and Italian.

He is survived by his wife, Maria Cristina Vicente-Puletti; his brother Hector, his sisters Esther and Amelia Puletti of Buenos Aires; mother and father-in-law, Catalina and Leoviglido Vicente; brother-in-law Jorge Vicente and numerous nieces and nephews.

SFMS Welcomes New Employees

The San Francisco Medical Society is pleased to welcome our newest employees, Therese Porter and Galen Foster.

Therese Porter

Therese Porter replaced Thomas Young as the SFMS membership director when he moved to New York in November to be closer to his family.

Therese Porter is a third generation native San Francis-can. She worked for many years in the department of ophthalmology at California Pacific Medical Center. In the course of her career she has been a choreographer, a stand-up comedian, a writer, and an executive assistant in the financial services industry. In her spare time she performs and directs at historically themed events such as the Renaissance and Dickens Faires.

Galen Foster hails from Anchorage, Alaska, and has previously worked in the advertising and food service industries. He will apply his computer tech skills by fine-tuning the newly installed SFMS database system and assisting Porter in the membership department.

Anyone with membership questions may contact Therese Porter at (415)561-0850, ext. 268, or by email at tporter@sfms.org. Galen Foster may be reached at (415) 561-0850, ext. 269, or by email at foster@sfms.org.

Calendar of Events

JANUARY 26, 2006 (THURSDAY)

SFMS Annual Dinner
Installation of 2006 President
Gordon L. Fung, MD
Delancey Street Catering Town Hall
600 Embarcadero
Call (415) 561-0850, ext. 260, to RSVP

JANUARY 21 (SATURDAY)

Town Hall Meeting
"Communities Coming Together to Explore Environmental Links to Breast Cancer"
Kaiser Permanent Medical Center
Oakland, CA

MARCH 15 - 17

Foresnsic Mental Health Association of CA
Annual Conference
Seaside, CA
CME for MDs, RNs. social workers, psychologists and corrections officers.
Formore information go to: www.fmhac.net

APRIL 4 (TUESDAY)

Legislative Leadership Day 2006 will be at the Sheraton Grand, Sacramento

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ENVIRONMENTAL JUSTICE INITIATIVE: SAN FRANCISCO FOUNDATION

Bay Area residents are often exposed to poor air quality, pollution generated from traffic, power plants, industrial sites, and toxic chemicals in consumer products. These environmental hazards disproportionately effect communities of color and low-income neighborhoods and are increasingly being linked to a range of conditions such as asthma, cancer, and birth defects.

The San Francisco Foundation established the Environmental Health and Justice Initiative in 2000 to address the impact of environmental factors on local communities. The Initiative works on and funds in three issue areas:

- Reducing the impact of toxins and chemicals on human health;
- Advancing and promoting the "precautionary principle" as a useful framework for improving and protecting public health; and
- Improving the Bay Area's air quality and addressing the effects of air pollution on human health.

For more information about the Initiative or to learn, support, apply, or partner with us, please contact the Foundation's Environment Program staff at (415) 733-8500

San Francisco Medical Society
1409 Sutter Street
San Francisco, CA 94109

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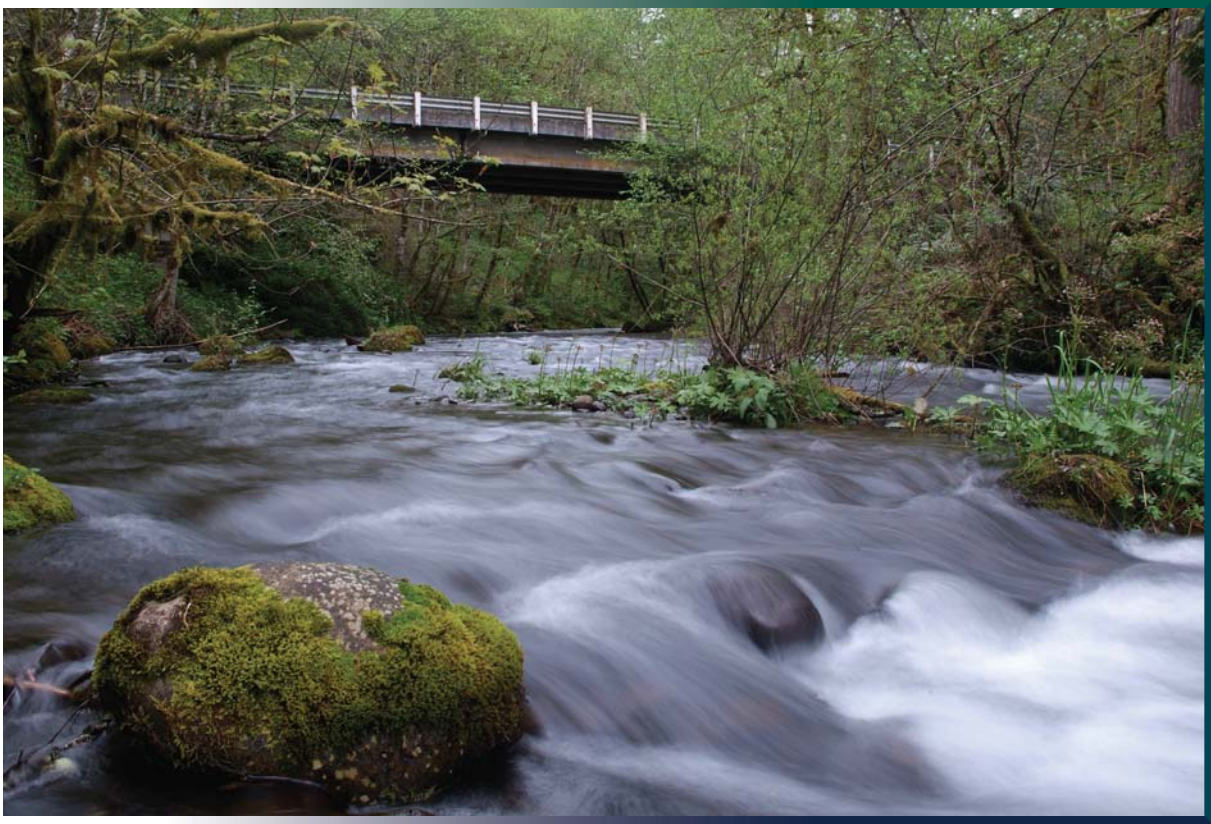

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