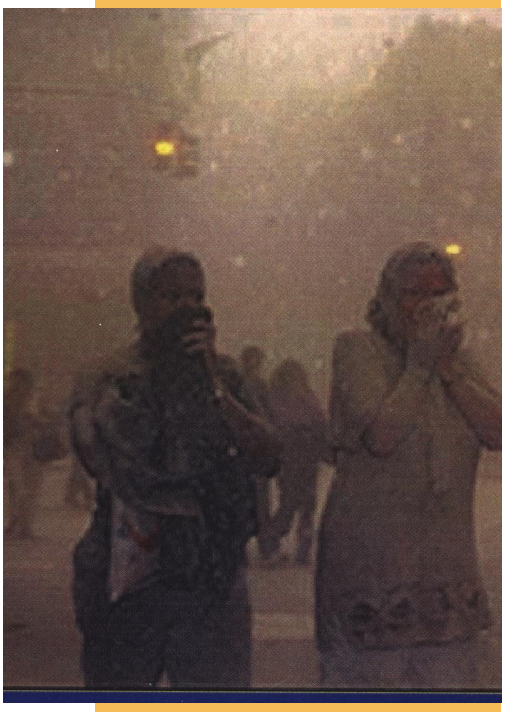
Your Health & the Environment

NEWS FROM THE UNIVERSITY OF ROCHESTER
ENVIRONMENTAL HEALTH SCIENCES CENTER • SPRING ISSUE 2003

World Trade Center Dust—Is It Toxic?



Drs. Günter Oberdörster and Jacob Finkelstein, Professors of Environmental Medicine at the University of Rochester, have been analyzing dust samples collected near the collapsed World Trade Center. The research study exposes lung cells to dust collected from apartment buildings, parked cars and streets in lower Manhattan to determine if the dust changes gene expression in the genetic structure of the lung cells in a way that would result in lung inflammation and respiratory infections. Most of the dust collected was concrete dust and, generally, it did not contain high levels of toxic substance(s). The preliminary findings of the studies do not indicate that there is any acute health risk to the people who live and work in the area, however, additional studies are being conducted to confirm the findings.

New York University is still conducting health tests on rescue workers from the Ground Zero area who were intensely exposed over a considerable period of time.

The study is funded by a National Institute of Environmental Health Sciences (NIEHS) supplemental grant awarded to New York University and the University of Rochester entitled "Toxicological Assessment of World Trade Center Dust." The purpose of the grant is to increase awareness of potential environmental health effects resulting from the WTC tragedy as well as provide the community with the most current information on the investigation.

The next phase of our study will look at the dust, combined with respiratory infections such as the flu, to see if it can make an illness worse. Within several months, this phase should be completed and by summer 2003, the University of Rochester's results should be compiled.

The University of Rochester Environmental Health Sciences Center is housed in the Department of Environmental Medicine, and is one of 25 such centers sponsored by the National Institute of Environmental Health Sciences, a component of the National Institutes of Health. Its research programs are designed to expand our knowledge about those environmental factors that influence our health. Some of the work undertaken and reported on in this publication is supported by NIEHS Center Grant ES01247. For more information go to: www2.envmed.rochester.edu/envmed/

Katrina Smith Korfmacher, Ph.D.

Our New Community Outreach Coordinator

We would like to introduce you to Dr. Katrina Smith Korfmacher, our new Community Outreach Coordinator for the Environmental Health Sciences Center. Dr Korfmacher brings to our Community Outreach and Education Program a wealth of training and experience as an environmental policy scientist as well as a background in academia and working directly with coalitions or partnerships involving researchers, policy makers, and citizens.

Dr. Korfmacher received her Ph.D. in environmental public policy from Duke University and after receiving her degree was employed as the Acting Director of the Environmental Studies Program at Denison University. She is also a Visiting Instructor at the Duke University Marine Lab and Adjunct Assistant Professor at Rochester Institute of Technology.

As Community Outreach Coordinator, Dr. Korfmacher's objective is to strengthen links between environmental health research and the information needs of the community, and her primary focus is addressing environmental health questions of the communities in and around Rochester. She participates in a number of local groups relating to environmental health including the Water Education Collaborative, the Monroe County Environmental Health Advisory Committee, and the Center for Environmental Information.

Much of her outreach work relates to childhood lead poisoning, which is the most significant childhood environmental health risk in the Rochester area. Dr. Korfmacher has been an active member of the Rochester Lead Free Coalition since 2001, serving on its Governmental Relations Subcommittee and Executive Committee. She is particularly interested in helping the Coalition translate environmental health information into its goals of improving relevant policy at the local, state, and federal levels. Specific projects have included helping develop a support group for families of lead poisoned children, working closely with the Monroe County Health Department's lead poisoning prevention program, seeking funding to increase the Rochester Lead Free Coalition's capacity, and calculating the current costs to society of childhood lead poisoning.

Dr. Korfmacher recently attended the National Lead Conference in Washington, DC. where she presented her data analyzing the economic costs of lead poisoning (medical costs, lost wages, proclivity toward violence and the need for special education). The presentation was well received by attendees at the Conference and they were interested in replicating the study for other states. Because lead poisoning is an important issue in the Rochester area, the expertise that Dr. Korfmacher brings to us, should prove to be invaluable.

Enjoy Old Age

By Dr. Bernard Weiss,
Professor of Environmental medicine

Enjoy Old Age is the title of a slim volume by the famed psychologist B.F. Skinner and his colleague, Margaret Vaughan. In addition to providing the foundation for the contemporary study of behavior, Skinner was also a creative inventor of useful methods and devices. *Enjoy Old Age* offers many instances of how some of aging's diminished functions can be overcome or reduced by adopting strategies for mastering or adapting to them. Becoming forgetful? Plaster the wall with Post-It notes. Having problems maintaining your balance when walking? Buy an elegant cane and flaunt it like a London dandy.

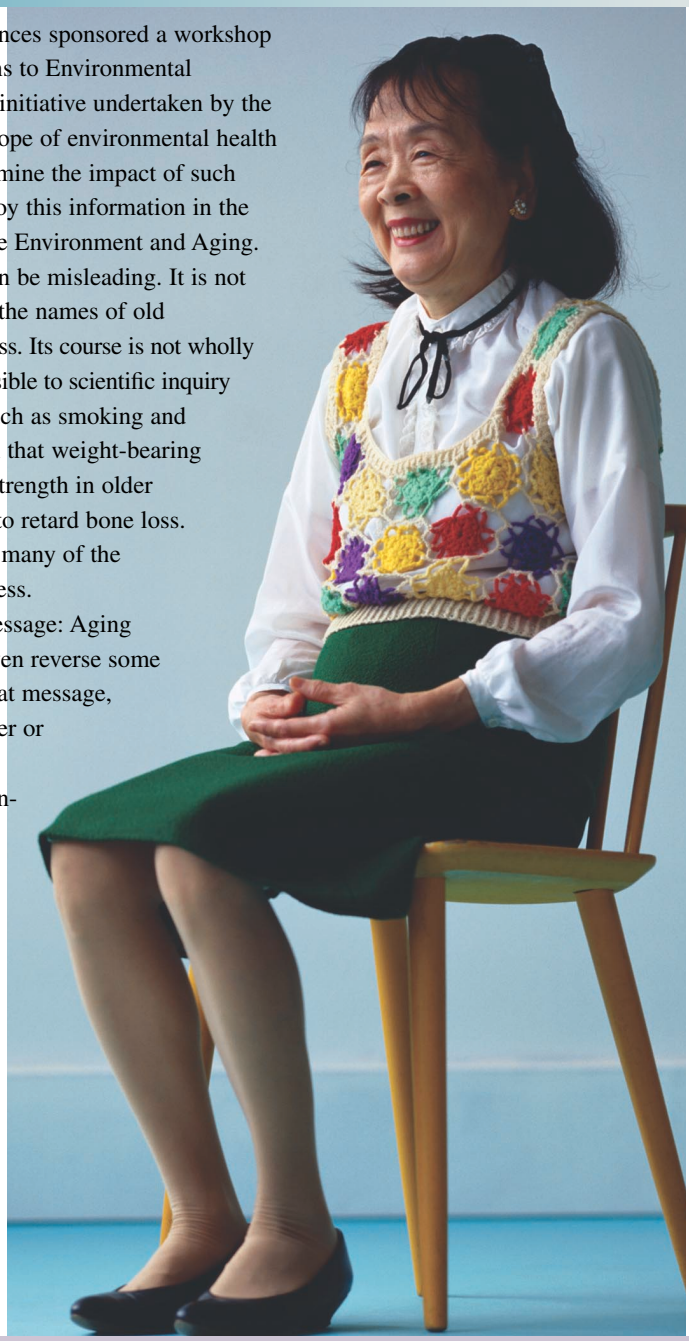
But enjoying old age is not simply a matter of devising techniques to reduce the impact of aging on how we feel and how we perform. The bigger difficulty is prevention or slowing of its consequences. We are now participating in a demographic onslaught never before seen in human history, a dramatic growth in the proportion of aging individuals that will challenge all our social and economic and medical resources. We must prepare to meet this challenge in multiple ways. One way is to understand how our environment shapes our ability to respond to aging. One critical component of that environment is its assortment of potentially harmful chemicals.

In December of 2002, the National Academy of Sciences sponsored a workshop entitled, “The Differential Susceptibility of Older Persons to Environmental Hazards.” The workshop represented one segment of an initiative undertaken by the U.S. Environmental Protection Agency to analyze the scope of environmental health threats faced by our rapidly aging population and to examine the impact of such a transformation on our environment. EPA plans to deploy this information in the development of a comprehensive National Agenda on the Environment and Aging.

The way we tend to use the term “aging,” though, can be misleading. It is not an explanation for our occasional inability to remember the names of old acquaintances or for our slowed reflexes. Aging is a process. Its course is not wholly predetermined. Like other biological processes, it is accessible to scientific inquiry and modification. We’ve learned that life style choices such as smoking and eating habits influence the diseases of aging. We’ve seen that weight-bearing exercise can contain or even reverse the loss of muscle strength in older people. We are cautioned to consume adequate calcium to retard bone loss. Scientists are optimistic that we can combat and control many of the results of aging by gaining an understanding of the process.

The progress we’ve already made conveys a clear message: Aging is amenable to intervention, and we can ameliorate or even reverse some of its troublesome effects. But there is another part of that message, its mirror image: It tells us that we should be able to deter or delay some of those effects by intervening during earlier stages of life. It tells us that protecting the environment also safeguards our health. It tells us that fostering a healthy environment for our young people can help secure their vigor as they enter old age. The EPA initiative aims to bring to the surface the connection between environmental pollution and the afflictions of aging. Some of these connections are disquieting.

Many environmental chemicals have the capacity to impair our immune system, our guardian against infection. They impose an added burden because immune efficiency diminishes as we age. Immune function is also reduced in older persons because they are often treated with multiple medications or already suffer from a chronic condition thatcan make them



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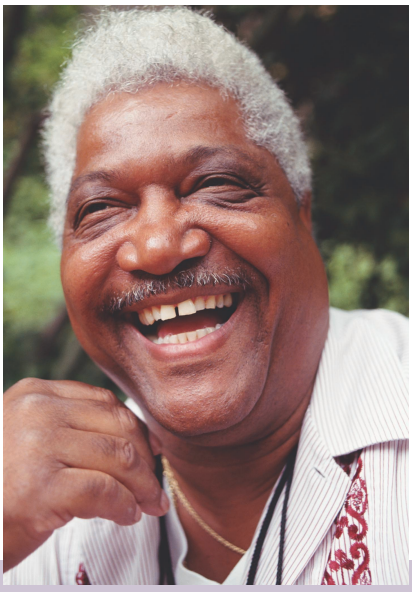
Enjoy Old Age (continued from page 3)

more susceptible to immune system interference. Microorganisms in drinking water that are difficult to eliminate with current methods, such as cryptosporidium, pose a much greater risk to those with lowered immune system function.

We also know now that older individuals are more susceptible to health risks from tiny dust particles, called particulates, in the air. One large study examined air pollution in 151 metropolitan areas in the U.S. It showed small but important increases in heart and disease associated with exposure to particulates, especially the smallest, those that most easily invade the deep recesses of the lung. Research at our Particulate Matter Center aims to understand how such ultrafine particles exert their effects, especially in combination with factors such as aging.

Osteoporosis is an affliction of aging that costs the nation many billions of dollars annually and that is responsible for many premature deaths. Investigators in our Environmental Health Sciences Center are exploring how exposure to lead earlier in life may foster osteoporosis late in life. They have seen evidence that bone density in older persons is reduced by the lead absorbed and stored in bone during childhood. Lowered bone density diminishes bone strength and increases the risk of fracture.

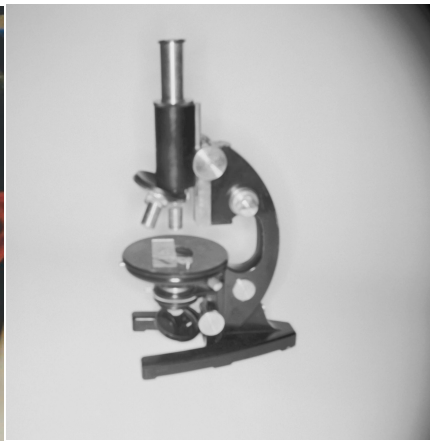
According to a recent survey reported in the New York Times, the most dreaded affliction of aging is loss of brain function, because that is what defines in essence who we are. Satchel Paige is remembered as a renowned pitcher in the old Negro Leagues before he gained a late chance in major league baseball. Along with his extraordinary athletic accomplishments, he is also remembered as a philosopher. Although no one ever thought of him as an expert on neurodegenerative disease, he enunciated a useful guiding principle: “Don't look back; something may be gaining on you.” That something is always gaining on us is certain, and we all try to elude it, but looking back is what we scientists do. We all accept the Paige principle that neurodegenerative diseases begin long before they erupt into perceptible disability. We cannot always state whether the process is inherently abnormal, or an acceleration of natural, universal aging, or a confluence of the two. The puzzle of how the process advances is one of the most profound challenges to brain science, but many clues tell us that aging must be accorded at least a secondary role: We know that performance on psychological tests typically declines with age. We know that the incidence of neurodegenerative disorders such as Alzheimer’s disease shows a sharp rise with advancing age. We know that key areas of the brain lose nerve cells as we age, restricting their ability to compensate for previous damage. We know that apparent recovery from an earlier neurological disability such as polio may revert with age.



We already possess many clues that brain damage inflicted earlier in life, what some of us call “silent damage,” may emerge late in life when the brain’s declining ability to compensate for that loss begins to wane. We’ve seen it happen in the elderly victims of Minamata disease, named after the fishing village in Japan where fish consumed by the inhabitants were contaminated by organic mercury discharged into the bay by a chemical plant. We have seen more and more evidence that earlier exposure to pesticides elevates the risks of Parkinson’s disease, a supposition that scientists at our Environmental Health Sciences Center are testing in animal models.

No one denies that we all slink toward decrepitude at the behest of instructions inscribed in DNA. Still, the rate and pattern of this regrettable journey are also determined by events and conditions that we encounter on this trek. Aging may put us at greater risk from environmental pollutants and pollutants may put as at greater risk for the infirmities of aging. Perhaps it is because we enter aging with systems already tarnished by exposures suffered much earlier in life. Perhaps it is because we already carry a toxic burden in our bodies.

What we do know for certain is that, starting even in the womb, exposure to contaminated surroundings may exert a powerful influence on our quality of life as our future evolves from our past. Those of us who explore the coupling between the environment and health understand that tomorrow is the incarnation of yesterday.



Life Sciences Learning Center Laboratory Skills Development Program

The Life Sciences Learning Center (LSLC) received a grant of $175,000 from the Toyota USA Foundation to create a laboratory skills development program for students in Rochester City middle and high schools. This program will provide Rochester City school students—who traditionally lack access to advanced science programs and go without many basic science educational resources within their schools—with tailored science learning opportunities both within their classrooms and at the LSLC. In addition, science teacher workshops will be provided to train science educators in laboratory-based teaching. The professional development sessions will also allow teachers to gain familiarity both with the LSLC lab and equipment and the program activities that their students are scheduled to attend. This innovative program aims to provide students from disadvantaged schools increased opportunities to gain understanding and appreciation of science and to instill confidence in those students who are often afraid to succeed.

Program fills a need

The LSLC hosted over 700 students from the Rochester City School District during the 2001-02 school year. We have seen first-hand what an incredibly positive experience the LSLC can be for these students and teachers. Unfortunately, we also realized the extra lengths to which we must go to properly prepare them for these intense sessions. Many Rochester City students are often not exposed to fundamental science tools such as pipettes or sometimes even microscopes and, therefore, they spend a significant part of their LSLC visit learning to use basic lab equipment and scientific methods before they can begin a science inquiry activity, detracting from their time for in-depth investigations. Many of these students are also not confident in their ability to do science and require quite a bit of reassurance from our LSLC instructors and their teachers. Students from more affluent schools automatically have a learning advantage before they ever step into the LSLC simply because they have more classroom resources. With preparatory intervention in their classrooms, disadvantaged students will gain the full opportunities available within the LSLC and have the opportunity to catch up to their peers in science. We specifically hope to encourage students from under-represented minority groups to further their science education and to view science as a possible career choice.

In-school "skills lab" sessions

Eight science teachers from the Rochester City School District (4 middle school and 4 high school) are currently participating in this program, which was begun with funding through an EHSC pilot project. Participating schools include Monroe Middle School, James Madison School of Excellence, Charlotte Middle School, East High School, Wilson Magnet High School and John Marshall High School. LSLC science educator, Jana Penders, and LSLC Director, Dina Markowitz, visit each school classroom for two preliminary laboratory sessions, during which they co-teach a series of inquiry-based hands-on science activities along with the science teacher. The "skills lab" activities are adapted for the needs of each class, and these targeted and specialized experiences provide students and teachers with the necessary preparation for their intensive LSLC session. These preliminary sessions also provide the LSLC staff with opportunities to build a rapport with the students, a crucial step for maintaining their respect and attention when they are in the LSLC lab. Support from the Toyota USA Foundation will allow for the expansion of this program into additional schools and will fund the hiring of an additional LSLC science educator.

Professional development workshops for the group of participating science teachers allow the teachers to become familiar with the preparatory and LSLC lab activities. The teachers are also provided with resources, such as use of the LSLC equipment lending library, to help them incorporate these laboratory investigations into their existing curriculum.

An investigation of the effectiveness of this program is being undertaken by Dr. Markowitz and Dr. April Luehmann, Assistant Professor of Science Education in Teaching and Curriculum at the University of Rochester Warner Graduate School of Education. This research study will examine the outcomes of studentswho participate in the LSLC laboratory skills development program and compare them with their peers (same teacher but different classes) who visit the LSLC without completing the in-school preliminary activities. We hope that this program will result in a marked increase in student knowledge, attitudes, behavior and skills.

For more information about the LSLC, visit: www.2envmed.rochester.edu/lifesciences/

Amber Wyman,

fourth year graduate student in the

Toxicology Training Program

is doing her research work in the laboratory of Dr. Thomas Gasiewicz. Amber received her B.S. from the University of Washington, Seattle.

Tetrachloro-dibenzo-p-dioxin (TCDD, or dioxin) is a by-product of industrial manufacturing that is found in all parts of the world. It is best known as a contaminating component of the defoliant Agent Orange, which was used in Vietnam and to which many Vietnam veterans and Vietnamese were exposed. TCDD is a very stable chemical that does not break down quickly in the environment. It also has a long half-life in animals, residing in the fat stores of animals and humans who ingest it. For these reasons, TCDD bioaccumulates, or concentrates, as it moves up the food chain. Since humans are at the top of the food chain, we unavoidably carry a body burden of this chemical. However, since TCDD is one of the most toxic chemicals in existence, it is not know at what levels toxic effects may be seen.

TCDD has been shown to have toxic effects on many organ systems. At very low levels, TCDD has been shown to decrease the immunocompetence of children exposed before birth, manifesting itself as a decreased ability to fight off viral infections. At higher doses, skin lesions (chloracne), wasting syndrome, and immune dysfunction are seen in humans. Animal exposures to low levels of TCDD result in liver lesions, immune suppression, wasting syndrome, and fetal malformations. There is also some evidence to suggest that TCDD may act as a carcinogen.

Our laboratory is interested in examining the effects TCDD has upon the immune system—in particular, the bone marrow cavity. The immune system, unlike other organ systems, has many components located throughout the body. The bone marrow contains the precursors for all blood cells, as well as the hematopoietic stem cell from which they all derive. After development within the bone marrow cavity, blood cells migrate to the circulation or, in the case of T lymphocytes, to the thymus. The spleen and lymph nodes are immunological organs through which immune cells circulate and participate in fighting infection.

The stem cell from which the immune system is derived has the capability of self-renewal, as well as differentiation into the various lineages of blood cells. Clearly, any insult to a "parent cell", the hematopoietic stem cell could be disastrous. Changes in this cell, caused by TCDD could conceivably be carried "downstream" to the other lineages of cells, creating permanent alterations in the ability of these cells to carry out their functions.

Thus, we would like to define the particular bone marrow cell type that is targeted for TCDD's toxic effects. Previous work suggest that it is a hematopoietic stem cell that is being directly targeted. My work and research is geared toward more precisely defining the subset of stem cell that is affected, in the hopes that future work can pinpoint the genes that are altered in this cell population. In this way it is hoped that the mechanism for TCDD's alterations to the immune system can be better understood.

How much does lead poisoning cost? by Katrina Smith Korfmacher, Ph.D.

As in many areas of the country, lead poisoning is generally acknowledged to be the most common environmental health risk to children in Rochester. Also as in other cities, the costs of preventing lead poisoning are enormous. The most recent experience in Rochester suggests that addressing the lead hazards in a home that has poisoned children costs an average of seven thousand dollars. Given the number of homes that pose lead hazards to children in a city where most of the housing was built before lead paint was banned, the total costs of remediation are mind boggling. It is important to put these costs in perspective, however, by estimating the benefits of eliminating lead poisoning.

A recent study by Landrigan et al. (2002) estimated that the annual costs of environmentally attributable diseases in American children total $54.9 billion, of which the vast majority ($43.4 billion) arise from lead poisoning.* What does this mean to a local community facing immediate expenses for remediation? This question is particularly significant for a community like Rochester, an economically distressed urban area in a state that does not provide financial nor legal support for the primary prevention of lead poisoning.

The literature on lead poisoning provides some guidance in estimating the costs of lead poisoning to society. The most common method links lead poisoning to lowered IQ, which in turn results in lowered lifetime earning potential. Calculations by this method suggest that the children born in the City of Rochester in 2000 will earn over a hundred billion dollars less over their lifetimes (in current dollars), than they would have if lead poisoning were eliminated.

More significant from a municipal perspective, however, are the immediate savings that would result from eliminating lead poisoning. A very conservative estimate is that 20% of children with blood lead levels over 25 µg/dL will require three years of special education. This means that Rochester is currently spending nearly a million dollars a year on special education that would not be necessary if children were not poisoned by lead.

Since the vast majority of lead poisoned children are on Medicaid, the costs of their medical care are borne by the public. Based on existing literature, it costs nearly half a million dollars per year to treat Rochester's lead-poisoned children. In addition to these immediate costs of treatment related to lead poisoning, ongoing research suggests a range of additional long-term health effects (and related medical costs), including hypertension and osteoporosis. If quantified, these long-term costs could dwarf the short-term costs of children's care.

A recent study by Needleman et al. (2002) found that the attributable population risk values of lead poisoning for juvenile delinquency varied from .11 to .38, depending on race and family income. Given that the current cost of residential placement alone is around $80,000 per year, this study suggests that eliminating lead poisoning could result in a significant reduction in juvenile justice system costs.

Thus, it is clearly in the long-term interest of society to invest in healthy housing to prevent lead poisoning and its associated hidden costs. Furthermore, the calculations of the immediate benefits in reduced medical, special education, and juvenile justice costs suggest that local governments may see immediate paybacks for money they spend to prevent lead poisoning.

If you are interested in carrying out similar costs estimates for your area, or would like more information on how these calculations were conducted, please contact Dr. Katrina Smith Korfmacher at *Katrina_korfmacher @urmc.rochester.edu* or by calling (585) 273-4304.

For additional information, please go to: *www.knowlead.com, www.aeclp.org* and also *www.epa.gov/lead/NLIC.*

*Landrigan et al. emphasize that this is a conservative estimate, particularly with respect to lead poisoning. they also note that, by comparison, health costs due to motor vehicle accidents are just over 80 billion per year for the entire population.

References

Landrigan et al. Environmental pollutants and disease in American children: Estimates of morbidity, mortality, and costs for lead poisoning, asthma, cancer, and developmental disabilities. Env. Health Perspect. 110(7):721-728, 2002.

Needleman et al. Bone lead levels in adjuducated delinquents: a case-control study. Ped. Research 47(4):155A, 2000.

Toxicology Training Program News

- David Lehmann, a 3rd year Toxicology student, was recently informed that he is a recipient of an award from the Sigma Xi Committee on Grants-in-Aid of Research to support his research project "Ethanol Regulates the Subcellular Distribution of Proteins in the Liver Involved in Messenger RNA Processing." Dr. Harold Smith is David's advisor.

- A number of our students will be attending the annual meeting of the Society of Toxicology in Salt Lake City in early March. Geniece McCollum and Joe Zhou have received travel awards to attend the meeting.

Save the Date

On Monday April 28, 2003 Dr. Devra Davis, world renowned epidemiologist and 2002 National Book Award finalist will present a community seminar entitled, "Tales of environmental deception and the battles against pollution: breast cancer and the environment." The event will be held at 7:00 pm at the Rochester Museum and Science Center and is sponsored by the EHSC Community Outreach and Education Program.

The seminar will be based on Dr. Davis's book "When Smoke Ran Like Water," which has been featured on Book TV and on Bill Moyers news show on PBS.

Dr. Davis is a Visiting Professor at the Heinz School of Carnegie Mellon University, and is also an Honorary Professor at the London School of Hygiene and Tropical Medicine. Dr. Davis is known for her groundbreaking research on the environmental causes of breast cancer and chronic disease. She earned her Ph.D. from the University of Chicago and a Masters of Public Health degree from Johns Hopkins University.

Dr. Davis will also appear at Barnes and Noble, Pittsford Plaza for a book signing on Sunday, April 27 from 7-9 PM.

- Fifth year and first year toxicology students Tenea Watson and Beth Van Winkle recently discussed toxicology concepts with a group of 10-12 year olds at Wilson Commencement Park (WCP), a Rochester inner-city community that fosters self-sufficiency within low-income, single parent families. The students used a study guide developed at the University of Washington called "Tox in a Box," which helped them to communicate broad toxicological concepts such as "the dose makes the poison," "toxin vs. toxicant" and "toxicology in our everyday lives" through visual aids and mini-experiments. The children were particularly fascinated by the fact that though they had never heard of toxicology, they were already familiar with several concepts that affected their everyday lives. They spoke of hazardous labels on prescription medication, dermal, oral and inhalation routes of exposure, and how the young, the elderly, and people with asthma or allergies can be especially susceptible to certain agents. Missy Brown, Early Learning Center Director at WCP, described the presentation as a "Class A Act." "I really wanted the children to see what scientists in different areas do and that a scientist can be any age, any sex, any nationality, etc. Tenea and Beth related really well to the children, which is what I believe to be so important in truly getting a message across." Tenea and Beth will return to WCP in the near future to help students with ongoing science projects.

For more information about our Toxicology Training Program, go to: *www2.envmed.rochester.edu/envmed/tox*. or call Joyce Morgan at (585) 275-6702.

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