There is a notable disparity in asthma prevalence between neighborhoods of New York City. Among children, asthma prevalence ranges from 3 to 19 percent in some neighborhoods. Proposed causes of asthma in inner-city neighborhoods include pests such as mouse, cockroach, dust mite, cat, and dog allergens. Most of the previous studies have investigated the effects of pests on asthma in communities across the U.S. where asthma prevalence is high. This study is unique in that the researchers focused on studying the association of pests, asthma prevalence, and sensitization in both high asthma prevalence neighborhoods (HAPNs) and low asthma prevalence neighborhoods (LAPNs) within New York City. This is the first study that attempts to highlight the disparities in health outcomes related to environmental exposures in adjacent neighborhoods.

The NYC Neighborhood Asthma and Allergy Study (NAAS), led by Dr. Matthew Perzanowski, is a case-control study with 239 children between ages 7 and 8 from HAPNs and LAPNs, recruited from a middle-income health insurance plan. By recruiting from this insurance plan, the authors attempted to minimize differences in socioeconomic status to better observe the differences between HAPNs and LAPNs. The recruited participants had an income range within the middle class, but lived in higher and lower socioeconomic communities.

Bed dust was collected in homes with a vacuum and analyzed for Der f 1 (dust mite), Fel d 1 (cat), Can f 1 (dog), Mus m 1 (mouse), and Bla g 2 (cockroach) allergens by multiplex bead immunoassays and ELISA. Sensitizations to the five pests were determined by measuring the serum levels for specific IgE antibodies to the five types of pest allergen. ...Continued on page 3
WE ACT for Environmental Justice held a press conference on April 22, 2011 where they revealed their first Environmental Health Report Card for Northern Manhattan. This report card, developed by WE ACT staff members Ogonnaya Dotson-Newman, Anhthu Hoang, and Peggy Shepard, was funded by the Community Action for a Renewed Environment (CARE) Program of the U.S. Environmental Protection Agency. The report card was developed to profile various hazardous conditions to which residents of Northern Manhattan are exposed.

Northern Manhattan, which includes Washington Heights, Inwood, West Harlem, Central Harlem, and East Harlem was rated a C overall on its first report card. Two grades were compared for various environmental issues: grades based on public data on environmental health, and another resulting from community members compiled through the CARE Collaborative. A grade of C indicates that environmental health status is below that of the rest of New York City, and that the disparities are not being addressed by any policies. Some environmental health issues that were graded are highlighted below with their grades (grade based on public data, community grade):

Indoor Air Quality (C, C) – indicators of indoor air include tobacco smoke, mold, and housing conditions. Houses built prior to 1950 are particularly hazardous because of lack of policies regulating lead-base paint and asbestos.

Outdoor Air Quality (C, C) – indicators include asthma hospitalization for children and percent of days above standard for ozone and PM$_{2.5}$. Sources of air pollution contributing to the poor air quality include truck traffic to and from the George Washington Bridge, sewage treatment and power generation plants, and bus depots.

Lead Poisoning (C, C) – indicators are incidences of lead poisoned children. Lead can be found in old pipes, chipping paint, toys, and jewelry.

Pests and Pesticides (C, C) – indicators include rat and cockroach sighting, pest sprays, and pest bomb use.

Solid Waste (B, C) – indicators include tonnage of solid waste collected and recycled per day and acceptably clean sidewalks and streets. Despite the city and state data suggesting satisfactory solid waste management, community members complain about overflowing garbage containers, litter on streets, and rat and cockroach sighting.

Access to Healthy Food (C, C) – indicators include ratio of supermarkets to bodegas and prevalence of diabetes and obesity. There is an abundance of fast food options and lack of supermarkets offering fresh produce in Northern Manhattan.

Drinking Water Quality (A, C) – indicator is contaminants in drinking water. The discrepancy between grades comes from the fact that water is delivered in old lead pipes to old homes in Northern Manhattan, contaminating the water after it has left the water reservoir in Catskill.

This report is critical in determining what steps need to be taken next to help reduce these exposures and allay the concerns of the Northern Manhattan community members.
They found that HAPNs had higher mean Bla g 2, Mus m 1, and Fel d 1, lower Der f 1, and similar Can f 1 allergens in bed dust compared to LAPNs. Among significant associations between pest allergen and sensitizations observed, the most notable was sensitization to cockroach in HAPN. Exposure to cockroach allergen was linked to sensitization, and sensitization was associated with increased risk for asthma. In this particular study, Dr. Perzanowski and his co-authors found that the best predictor of exposure to pest allergens was the income of the neighborhood in which the child resides. The main difference between HAPNs and LAPNs was the type of housing; apartments were more common in HAPNs and single homes in LAPNs.

The results of this research are important to children in urban neighborhoods in the Northeast. While pest allergen exposures vary in level and type among children between neighborhoods, sensitizations to cockroach, mouse, dust mite, and cat allergens are critical in predicting asthma morbidity.
Success of Two Pilot Studies

Successful pilot studies were conducted by Drs. Kinney, Whyatt, Chillrud, and Van Vliet ("Do improved cookstoves reduce exposure to air pollution? A randomized trial in Ghana") and Drs. Neidell and Graff Zivin ("The Impact of Air Quality on the Productivity of Agricultural Workers"). These pilot projects were granted additional funding for further investigation. The following discusses the next steps of their newly funded projects.

"Intervening to Improve Birth Weight and Infant Respiratory Health in Rural Ghana"
PI: Patrick Kinney

Three billion people living in developing countries use biomass fuels for cooking and heating purposes, and consequently, exposing themselves to particulate matter, carbon monoxide, free radicals, and hydrocarbons produced from inefficiently burned biomass. These exposures contribute to an annual 1.6 billion excess deaths. The majority of adverse health effects from biomass burning have been observed among women and infants, including acute lower respiratory infections (ALRI) and low birth weight in children and chronic obstructive pulmonary disease (COPD) in adults. The pilot study findings revealed that the level of exposure to PM$_{2.5}$ is proportional to the amount of biomass burned while cooking. The newly funded study will be the first to use a randomized controlled trial to assess whether improved cook stoves lead to a decrease in ALRI among infants and an increase in average birth weight in newborns in rural Ghana; most of the previous findings are from cross-sectional studies. Improved cook stoves will be given to pregnant women who are primary cooks in their household as part of either an early or late intervention, and exposures to carbon monoxide will be monitored for all women. Exposures to particulate matter will also be monitored in real-time for a subgroup of the participants. The findings from this study will provide further understanding of the link between biomass burning and adverse health effects as well as potential interventions that will minimize such health effects.

"The Impact of Environmental Conditions on the Productivity of Agricultural Workers"
PI: Matthew Neidell

Despite the known negative effects of poor environmental conditions, efforts for environmental protection for workers have been meager. Maintaining healthy environmental quality by advocating for improved standards of pollutants such as ozone could help economic growth. By minimizing such respiratory irritants, work productivity would increase for workers like farmers who spend the majority of their work hours outdoors. The impacts of long-term exposure to ozone on the health of workers, and consequently on work productivity, have not been investigated in depth. The pilot study found that a 10 ppb decrease in ozone concentration increased worker productivity by 4.2 percent. The purpose of the newly funded study is to assess further the effect of ozone and temperature on worker productivity by using a new dataset of farm worker output combined with data on environmental factors. Further, worker characteristics such as age and gender will be studied to determine potential differential effects of pollution on worker productivity. The findings from this study will reveal impacts of ozone and temperature on workers and can provide insight into how to improve standards to stimulate economic growth.
Four new pilot projects were funded in July. The following are abstracts for each of these projects.

“Examining the Effects of Chlorpyrifos on Attention and Neurodevelopment”
PI: Jonathan Posner, MD, Assistant Professor of Clinical Psychiatry
Amount: $25,000

This study aims to examine the effects of prenatal exposure to chlorpyrifos (CPF) on neuroanatomical correlates of attention. The study will be conducted in collaboration with Drs. Virginia Rauh and Bradley Peterson, who are currently carrying out an R01-funded prospective study of the impact of environmental pollutants on brain development. As part of the Rauh–Peterson study, resting-state functional magnetic resonance imaging (rs-fMRI) scans have been obtained in 40 children at ages 7–9 for whom CPF levels in umbilical cord blood have been recorded. For the funded pilot, funds were requested to process and analyze the 40 rs-fMRI scans from 20 children with high and 20 with low levels of CPF exposure. The goal is to examine the influence of CPF on the neural connectivity of the brain’s default mode network (DMN)—a neural network critical in establishing attentional regulation. The principal hypotheses are that in the children who are CPF exposed prenatally vs those who are unexposed, elevated symptoms of inattention and hyperactivity and altered neural connectivity within the brain’s DMN will be found; and that finally the altered connectivity within the DMN will mediate the relationship of CPF exposure with the symptoms of inattention and hyperactivity.

“Investigation of a role for manganese in regulating mitochondrial dynamics”
PI: Liza Pon, PhD, Professor, Dept. of Pathology and Cell Biology
Amount: $25,000

Parkinson’s disease (PD), the second most common neurodegenerative disease, is associated with movement disorders and cognitive disorders with dementia commonly occurring in the advanced stages of the disease. A number of risk factors have been identified that predispose individuals to PD. For example, exposure to certain pesticides or herbicides (e.g. Agent Orange) can double the risk for PD, and exposure to heavy metals may also be a risk factor. Manganese (Mn) is an essential nutrient; however, at high levels Mn is toxic and produces a severe, debilitating neurological disease that resembles PD. Chronic exposure to low levels of Mn leads to defects in motor coordination of fine movements. Moreover, one of the pesticides that increases the risk of PD contains Mn. These findings led to the model that chronic lifetime exposure to very low levels of Mn is a PD risk factor. We propose to study the mechanism underlying Mn toxicity and the effect that Mn has on mitochondria, the organelle that produces energy in cells. Neurons have high-energy demands and are severely compromised by defects in mitochondrial function and by defects in localizing functional mitochondria to their sites of action within cells. Moreover, Mn is known to have effects on mitochondrial energy production. Our central hypothesis is that excessive Mn impairs mitochondrial function at the pre-synaptic terminals, through effects on mitochondria, transport or anchorage of mitochondria in the pre-synaptic terminal of dopaminergic neurons and/or effects on mitochondrial fusion/fission and autophagy at this site. This in turn diminishes local ATP synthesis or calcium buffering required for normal dopamine release. We propose to study the effect that Mn has on mitochondrial function and localization in pre-synaptic structures in primary dopaminergic neurons. We will study how Mn affects mitochondria function within the context of the living cell and assess the role of autophagy and mitochondrial fusion and fission, processes that can lead to degradation of dysfunctional mitochondria, in elimination of Mn-damaged mitochondria. We also will determine whether mitochondria are mislocalized after Mn treatment, and use live cell imaging to determine whether the mislocalization is due to defects in motility and/or anchorage of mitochondria in axons and the presynaptic terminal. Finally, we will determine which of these machineries plays the most prominent role in Mn-induced mitochondrial toxicity. The proposed studies will extend our understanding of how environmental factors contribute to or pre-dispose individuals to PD. In addition, the molecules involved in the Mn-induced defects of mitochondria, once obtained, will serve as potential therapeutic targets for a cure.
“Function of Hairless in UV-induced Skin Cancer Susceptibility”
PI: Liang Liu, PhD, Associate Research Scientist, Dept. of Dermatology
Co-PI: Angela Christiano, PhD, Professor in the Dept. of Dermatology
Amount: $25,000

Non-melanoma skin cancer (NMSC), including squamous cell (SCC) and basal cell (BCC) cancers, is the most prevalent type of human cancer. A well-known, common cause of skin cancer is excessive exposure to UV irradiation from sunlight that can cause DNA damage, inflammation, skin aging, and eventually skin cancer. Multiple signaling pathways and transcription factors have been investigated to understand the connection between sun exposure and skin cancer, however, the exact mechanisms underlying UV action in promoting skin cancer development await further exploration. The hairless gene is a key regulator of the balance between cell proliferation and differentiation in the skin. Mutations in hairless cause permanent hair loss in both humans and rodents. Mice that harbor functional mutations in hairless are extremely susceptible to developing skin cancer in response to UV irradiation. Microarray analysis of hairless-mutant versus wild-type mouse skin identified genes that are regulated by hairless including cell cycle regulation and apoptosis genes, and in particular, numerous genes that are known targets of NFκB signaling. These novel findings, together with our previous observations of unregulated apoptosis in the hair matrix of hairless mutant mice strongly suggest that loss of hairless function in the skin may play a causal role in skin photocarcinogenesis. We will test the hypothesis that hairless is a key regulator of the balance between cell proliferation and differentiation via its novel role as an epigenetic regulator of target gene activity. We will attempt to address the following three essential questions: 1) how does hairless function in the skin; 2) does hairless control cancer growth via regulating the activities of other genes; 3) can we reduce UV-induced skin cancer incidence by restoring or enhancing hairless function in skin cells?

“Exposure to Elevated Levels of Combustion-Related Air Pollutants and Asthma among Non-Atopic Children in Beijing, China”
PI: Beizhan Yan, PhD, Lamont Assistant Research Professor
Amount: $25,000

In our NYC asthma studies, substantial efforts have been made to examine associations between exposures to incomplete combustion-related air pollutants (e.g., polycyclic aromatic hydrocarbons (PAHs), black carbon (BC) and metals) and asthma symptoms. Recent work has extended these efforts to investigate biomarkers of airway inflammation and oxidative stress in exhaled breath condensate (EBC) as biomarkers of effect. Observed associations appear to be stronger among the non-atopic children (i.e., those without sensitization to inhalant allergens). Due to the higher and wider range of concentrations of combustion byproducts in China than those found in NYC, studies carried out in China can aide in understanding the relationship between exposure to combustion byproducts and the biomarkers of inflammation and oxidative stress, measurement of which are being developed in Dr. Yan’s laboratory in collaboration with Dr. Perzanowski. The proposed pilot study will recruit 30 non-atopic asthmatic children, ages 9-10, in central Beijing and an outer suburb so that the study population will live in areas with a wide range of air pollution levels. Indoor and outdoor PM2.5 filter samples will be collected and personal exposure of black carbon will be monitored in two sampling periods (one week in heating season and the other in non-heating). Lung function and biomarkers of airway inflammation and oxidative stress in EBC will be measured in the end of each sampling period. The overall goal of this pilot study is to demonstrate the feasibility of environmental asthma studies in Beijing through collaboration between Columbia University and the China CDC and generate pilot data.
Past Events

Center Retreat

The NIEHS Center for Environmental Health in Northern Manhattan retreat was held on June 3, 2011. The retreat was held to review the work and accomplishments of the center members as well to receive feedback from the external advisors for the center’s competitive renewal. The retreat began with an overview of the past year by Dr. Santella, followed by a summary of the Career Development Program by Dr. Graziano, and a review of the Pilot Project Program by Dr. Guilarte. This was followed by an overview of each of the facility cores and of the collaborative work of the Community Outreach and Engagement Core (COEC) and WE ACT for Environmental Justice. Short presentations were given by a new Center member, Dr. Julie Herbstman, a predoctoral student, Megan Niedzwiecki, a postdoctoral scientist, Kirstie Stansfield, and a more senior Center member, Dr. Jeanine D'Armiento, highlighting some of the research being conducted in the Center. Finally, the retreat wrapped up with a discussion with the external advisors that provided suggestions for ways to highlight the accomplishments of the Center in the upcoming competitive renewal.

Diane Levy’s Data Management Workshop

Diane Levy held a workshop on data management on June 22, 2011. It was a successful workshop with 33 participants including center members, lab technicians working in Center members' labs, visiting post docs from South Africa, collaborators from NYU, EHS department students and staff members from the Columbia Children's Center and WE ACT for Environmental Justice. Data management is a critical component of all research; without good data management, results cannot be properly analyzed and the whole study will not yield any meaningful findings. Ms. Levy discussed the importance of producing clean and analyzable data for statisticians by managing the flow of data. Managing data flow includes planning out how the data will be acquired and by whom and when, how the data are entered and stored, and how it is disseminated. Ms. Levy emphasized the usefulness of relational database systems such as Microsoft Access and Microsoft Structured Query Language (SQL) Server for large-scale studies that require gathering and managing large amounts of data. To end the workshop, she demonstrated basic tools and steps on how to input data in Microsoft Access.

Double Discovery Medical Center Lab Tour

On July 8, 2011, the Center held a tour for excelling high school students interested in science in the Columbia Double Discovery Center program. The tour was very successful with highly engaging young students. The tour started with an introduction to the research conducted in the labs of Drs. Santella, Perzanowski, and Tang, followed by a tour of the labs. In Dr. Tang’s lab, the students learned about the importance of labeling samples correctly and DNA amplification, and saw polymerase chain reaction thermal cyclers. In Dr. Santella’s lab, the students learned about Biomarkers and saw lung cancer cells under a microscope. In Dr. Perzanowski’s lab, the students learned about disparities in asthma prevalence in New York City and how dust samples are collected at homes for the study. The students also had a hands-on experience of measuring their level of lung inflammation, an indicator of having allergies, using equipment that measures the level of nitrogen oxide in the air we exhale. The lab tour was followed by a “Toxic and Treasure Walking Tour” led by WE ACT staff, Ogonnaya Dotson-Newman. The tour started at the 145th Street entrance of the Riverbank State Park and ended at West Harlem Piers Park by 125th Street. She pointed out various hazards in the park such as the North River Wastewater Treatment Plant and smog from traffic, as well as treasures such as the farm found in the park.
### Welcome to the New Center Members!

Jeffrey Shaman, Ph.D., Assistant Professor of Environmental Health Sciences with a specialty in climatology; interested in respiratory disorders/biomass working group; Full Center Member

Matthew Neidell, Ph.D., Associate Professor of Health Policy and Management; interested in respiratory disorders/biomass working group; Full Center Member

Diane Gourion-Arsiquaud, Ph.D., Associate Research Scientist, Dept. of Pathology and Cell Biology; interested in ALS and neurotoxicity; Associate Center Member

Jing Shen, Ph.D., Assistant Professor of Clinical Environmental Health Sciences; interested in cancer and microarrays/epigenetics working group; Associate Center Member

Beizhan Yan, Ph.D., Lamont Assistant Research Professor; interested in indoor and outdoor air pollution/biomass working group; Associate Center Member

### Next Center Meeting

Thursday, November 3rd, 12-2pm  
722 West 168th Street, Rosenfield Building, Room 1101  
Lunch will be served.

### Fall 2011 Upcoming Events

Oct. 24: COEC Peer Cluster Evaluation at Columbia; COEC directors and staff from JHU, UPenn, and UMDNJ will be joining us to evaluate the Columbia COEC; 9:30-4:00pm; 630 West 168th Street, P & S Building, Room 16-419

Oct. 27: David Peden, MD, Professor of Pediatrics, Medicine & Microbiology/Immunology at UNC Chapel Hill, NC, "Human Studies of GSTM1 and Response to Pollutants;" 722 W. 168th St., 11th floor, Room 1101

Nov. 17: Andrea Baccarelli, MD, PhD, Harvard School of Public Health, Dept. of Environmental Health, "Epigenetic Influences of Environmental Pollutants - Findings from Human Studies;" 722 W. 168th St., 11th floor, Room 1101

### Information

**Publications:** Please remember to acknowledge the Center grant number P30 ES009089 on any publications that have relevance to the goals of the Center or that have utilized the services of the Center Facility Cores.

For more information about the Center, please visit our website:  
http://www.mailman.hs.columbia.edu/academic-departments/centers/niehs-center-environmental-health