Beijing Forum 2019
Environmental Health
—A Joint Event of AGU Centennial and MAIRS (III)

On the morning of November 3, 2019, the second day of thre Environmental Health–Joint Event of AGU Centennial and MAIRS, one of the sub-forums of Beijing Forum (2019), opened as scheduled at Dong Xu Conference Hall, School of Economics, PKU.

The forum began with a keynote presentation from professor Tao Shu from the College of Urban and Environmental Sciences, Peking University. His speech was titled "Health Impact of PM2.5 in Air Are Dominated by Residential Solid Fuel Emissions in China". Professor Tao first introduced his exploration of the contribution of indoor/outdoor pollution sources to PM2.5 pollution through field measurements, questionnaires and statistical modeling. It was found that residential solid fuels indoors are an important source of outdoor air pollution, while indoor air pollution without solid fuel use is significantly correlated with ambient pollution. Therefore, the emission of air pollutants from residential and non-residential sources needs to be reduced simultaneously to achieve optimal control effects. Second, Tao proposed that rural population is more important as both sources and receptors in China. Finally, for indoor pollution sources, biomass burning and cooking areas are important as coal combustion and heating. The use of these fuels is related to the geographical environment and the socio-economic status of the residents. When formulating policies to control solid fuels, it must be tailored to local conditions.

Following, the fifth session of this forum, themed "Indoor Environment and Human Health ", was started. The panel chair was Jeffrey Brook, assistant professor of Dalla Lana School of Public Health, University of Toronto.

First, professor Zhang Yinping, from the Department of Building Science, Tsinghua University, gave a presentation titled "Indoor Air Quality: What and How to Control?" Professor Zhang pointed out that to solve the problem of indoor air quality in China, it is necessary first to clarify the target and identify key pollutants based on the dose-effect relationship and burden-of-disease assessment. Second, a threshold standard needs to be set. Third, we need to control air pollution during the design stage of the building, by estimating indoor pollutant concentrations using dynamic methods such as C-history model, and to introduce national standard method for measuring the concentration

of pollutants. Fourth, the effectiveness of control measures should be evaluated by toxicology study based on mice models and intervention study based on biomarkers.

The second speaker was professor Guo Xinbiao, from the School of Public Health, Peking University. His presentation was titled "Indoor Particulate Matter Exposure and Cardiopulmonary Function in Adults and Children". Professor Guo investigated the effects of indoor particulate matter and ozone on cardiopulmonary function in children and adults. It was found that indoor particulate matter emitted from cooking, smoking and cleaning significantly reduced lung function and heart rate variability (HRV) in adults; while indoor ozone exposure significantly reduced children's cardiac autonomic function and raised heart rate, although the effect on lung function was not significant.

The third speaker was Liu Yingjun, assistant professor of the College of Environmental Sciences and Engineering, Peking University, and his presentation was titled "Characterizing Occupants' Exposure to Volatile Organic Compounds in Four Newly-Built Apartments in Beijing". Dr. Liu Yingjun pointed out that in new buildings that have not been finished and furnished, solvents, paints, glues and boards may release volatile organic compounds (VOCs), posing a potential health risk. Liu conducted a field campaign in five new apartments in Beijing, measured the VOCs in the apartments, and found that the concentrations of formaldehyde and benzene were less of concern. Ventilation, cooking, smoking and other human activities, however, played a key role in terms of VOCs pollution indoors.

After a short break, the sixth session of the sub-forum was started, themed "Emerging Technologies and Issues in Environmental Health Studies". The chair of this panel was professor Qiu Xinghua, from the School of Environmental Science and Engineering.

The first presenter was professor Yinon Rudich, of the Department of Earth and Planetary Sciences, Weizmann Institute of Science, who spoke on "Establishing Connections between Aerosol Chemical Composition and Possible Health Effects". Professor Rudich explained the health effects of particulate exposure through laboratory studies and established an association between the chemical composition of particulate matter and biological effects. He pointed out that photochemical aging increases the toxicity of secondary organic aerosols (SOA) and was associated with increased peroxide and free radicals. In addition, Professor Rudich found that polycyclic aromatic

hydrocarbons (PAHs) in wood tar caused oxidative stress and cell death, while mitochondria might be the first damaged organelle in oxidative stress-induced apoptosis. Finally, Rudich pointed out that PAH might also harm remote organs, such as the liver, which was related to the gene expression of related enzymes.

The second speaker was professor Mike Bergin, from the Department of Civil and Environmental Engineering, Duke University, who gave a presentatiaon titled "Low-cost sensors and deep learning: Improving the future of the environment and human health." Professor Bergin suggested that low-cost sensors for measuring air pollutants online are currently available in the environmental field. These sensors, which use deep learning techniques for data acquisition and calibration, can be useful tools in individual exposure analysis for population studies and large-scale atmospheric environmental monitoring. The sensors hold great promise in the field of environmental health. Bergin pointed out that the use of these sensors requires intense collaboration among scientists of all fields. Experts on computer sciences should be introduced into environmental health field to solve environmental problems with data science.

The third speaker in this session was professor Jeffrey Brook, from the Dalla Lana School of Public Health, University of Toronto, who gave a presentation titled "Building the foundations for virtual life course cohorts through common environmental data." First, Professor Brook pointed out that in the field of environmental health, external exposure has strong spatial variability, so we must increase the scope, availability, and geographic coverage. Exposure of local context is also important, especially for urban areas. Subsequently, Brook cited multiple Canadian cohort studies to demonstrate the application of consistent exposure assessment of life course in the field of environmental health. He pointed out that although some studies considered the residential history and assessed historical exposure, the assumptions are large and the data is limited; while the temporal nature of exposure and the chronic disease development/recovery requires focused research to explore. Finally, Brook suggested that the current "virtual life course cohorts" approach expands environmental health research ideas and provides opportunities for deep insight into public health issues such as disease prevention and management.

The final presentation of this session was delivered by Fang Mingliang, assistant professor of the School of Civil and Environmental Engineering, Nanyang Technological University. His speech was titled "'Every Little Makes a Mickle': Deciphering Human Exposome". Dr. Fang proposed

that Exposome is an important but challenging problem in the field of environmental health. There are many problems, such as difficulty in detecting biomarkers, high time and money cost of analysis, and complex health effects. Fang pointed out that through the combination of several liquid chromatography derivatization methods, we can significantly increase the detection limit of biomarkers. This derivative platform can possibly characterize human exposure groups in a time-saving and cost-effective way. Finally, Fang suggested that environmental or human-related levels of chemical mixtures can significantly alter cellular activity, and the "counting out" method using high-throughput metabolomics methods can decode the contribution of each compound to health effects.