School of Community Health Sciences
Department of Environmental and Occupational Health

In partial fulfillment of the requirements for the degree of
Master of Public Health

Rachel Kolberg
will defend her thesis:

Evaluation of fluorescence method for quantifying bioaerosol concentrations on air quality samples

Abstract

Airborne particulate matter (PM) in outdoor environments contains many components which cause adverse human health effects. The size of the particulates determines in what manner the particles would bypass the body's defense mechanisms to enter the respiratory system and is directly related to their health impacts. Currently the United States Environmental Protection Agency (U.S. EPA) are enforcing the National Ambient Air Quality Standards (NAAQS) to regulate the annual and 24-hour average concentrations of $PM_{2.5}$ and PM_{10} in the air. $PM_{2.5}$ are fine particles with aerodynamic diameter <2.5μm, small enough to reach the deepest parts of the bronchi and lungs. PM_{10} include $PM_{2.5}$ and larger particles with aerodynamic diameter of 2.5-10 μm. Both $PM_{2.5}$ and PM_{10} contain multiple components from multiple sources. Bioaerosols are an important component of PM, but there is limited knowledge about how bioaerosols contributes to $PM_{2.5}$ and PM_{10} concentrations. There is also a lack in research about the incidence and prevalence of disease caused by bioaerosols and about the limits of exposure to bioaerosol particulates. The main barrier to assess bioaerosol concentrations and health-related effects is the absence of quick, and inexpensive methodology for quantifying bioaerosols. This study explored the feasibility of using fluorescence microscopy to quickly quantify bioaerosols in $PM_{2.5}$ and PM_{10} collocated on polycarbonate filters. Bioaerosols were stained with DNA marker directly on filter, followed by fixation, microscopic imaging, and automatic counting. The method was first validated using reference samples prepared by depositing different known concentrations of *E. coli* onto blank polycarbonate filters. The results indicated a linear response over two orders of magnitude ($r^2 = 0.9$) and an accuracy within ±25%. *E. coli* were also deposited onto selected ambient PM_{10} and $PM_{2.5}$ filter samples to determine if pre-loaded particles would interfere bioaerosol imaging and counting. It was found that despite of an increase in uncertainty (variability), the calibration slope remained within ±10% of unity for both $PM_{2.5}$ and PM_{10} samples. Bioaerosol concentrations in ambient samples, as quantified by this method, were on average 14% higher for PM_{10} than for $PM_{2.5}$ acquired concurrently in a desert environment of Las Vegas, Nevada. The application of this method to other types of compliance filters, such as Teflon filters and tapes of a Beta Attenuation Monitor were also explored in this study. By means of a high-yield approach this method is expected to facilitate bioaerosol research, support exposure and health assessments, and help refine NAAQS for $PM_{2.5}$ and PM_{10}.

Date: Wednesday, May 24, 2017
Time: 10:00 a.m.
Location: BHS 131

Faculty, students, and the general public are invited.

Committee In Charge:
Dr. L.-W. Antony Chen, Advisory Committee Chair
Dr. Mark Buttner, Advisory Committee Member
Dr. Jennifer Pharr, Advisory Committee Member
Dr. Vernon Hodge, Graduate College Representative