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Georgia Southern Receives NIH R21 grant to explore the role of interplay between environmental exposures, respiratory tract microbiome, and immune responses in children

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The National Institute of Environmental Health Sciences (NIEHS), one of research institutes and centers that comprise the National Institutes of Health (NIH) has awarded a new Exploratory/Developmental Research Grant Award (R21) entitled, "Traffic-related Air Pollutants and Respiratory Tract Microbiome in Children." Dr. Atin Adhikari, an Assistant Professor of Environmental Health Sciences at Jiann-Ping Hsu College of Public Health is one of the Principal Investigators (PIs) in this multi-PI grant. The interplay between environmental exposures, respiratory tract microbiome, and immune responses related to asthma and other respiratory diseases is not well understood. High levels of traffic-related air pollutants (TRAP) have been associated with children’s asthma. TRAP can increase adherence of microorganisms to the epithelial cells of the respiratory tract and damage the epithelial layers resulting in increased susceptibility to microbial growth. Many studies suggest a role for altered human microbiota in the etiology of asthma. Furthermore, circumstantial evidence indicates that bacterial infections in the respiratory tract may play a role in asthma development. The airway microbiota may interact with the innate and adaptive arms of the children’s developing mucosal immune system in the respiratory tract, which can be critically important in maintaining tolerance against allergic immune responses. This new research study will examine the influences of TRAP and indigenous bacteria of the respiratory tract on allergic immune responses and asthma. The researchers at University of Cincinnati and Dr. Adhikari will jointly explore how long-term exposure to TRAP could influence the respiratory tract microbiome of the children utilizing a unique cohort of the Cincinnati Childhood Allergy and Air Pollution Study as well as the previously collected TRAP exposure data incorporated in a land use regression (LUR) model.
Georgia Southern Examine Problems of Air Monitoring during Destruction of Bio-weapon facilities

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Destruction of bioweapon facilities due to explosion or fire could aerosolize highly pathogenic microorganisms. The post-event air quality assessment is conducted through air sampling. A bioaerosol sample (often collected on a filter for further culture-based analysis) also contains combustion products, which may influence the microbial culturability and, thus, impact the outcome.

In this study, the interactions between spores deposited on collection filters using two simulates of Bacillus anthracis (anthrax bacteria) and incoming combustion products of Al as well as Mg and B-Ti (common ingredient of metalized explosives) were investigated. Spores extracted from Teflon, polycarbonate, mixed cellulose ester (MCE), and gelatin filters (most common filter media for sampling of air microorganisms), which were exposed to combustion products during a short-term sampling, were analyzed.

The researchers found that aluminum combustion products surprisingly enhanced the culturability of some bacterial endospores on Teflon filters increasing the culturable count by more than an order of magnitude. Testing polycarbonate and MCE filter materials also revealed a moderate increase of culturability although gelatin did not. No effect was observed with either of the two species interacting on either filter media with products originated by combustion of Mg and B-Ti. Sample contamination, spore agglomeration, effect of a filter material on the spore survival, changes in the spore wall ultrastructure and germination, as well as other factors were explored to interpret the findings. The study raises a question about the reliability of certain filter materials for collecting airborne bio-threat agents in combustion environments.

"Culturability of Bacillus spores on aerosol collection filters exposed to airborne combustion products of Al, Mg, and B-Ti," was published in Environmental Research.

Dr. Atin Adhikari, Assistant Professor for Environmental Health Sciences at the Jiann-Ping Hsu College of Public Health Georgia Southern University was the lead author.