9BA.1
Design and Development of a Self-Contained Personal Electrostatic Bioaerosol Sampler (PEBS). TAEWON HAN, Gediminas Mainelis, *Rutgers, The State University of New Jersey*

The goal of this project is to develop a personal electrostatic bioaerosol sampler (PEBS). PEBS is a two-stage electrostatic precipitator consisting of a novel wire-to-wire charger and a dual half-cylinder collection chamber. The newly designed wire-to-wire charger produces very low ozone concentrations (only ~ 10ppb) compared to more traditional charger designs, such as wire-to-cylinder or wire-to-plate. This new charging concept allows maintaining desirable physiological characteristics of collected bioaerosols during a long-term sampling process, leading to a more accurate sample analysis. When PEBS is operated, aerosols (and bioaerosols) are drawn into an open channel collector, electrically charged by the wire-to-wire charger and deposited onto a removable stainless steel plate. A one-inch long tungsten wire (0.003 inches in diameter) is positioned in the center of the charging chamber (i.e., 1-inch cylinder) and connected to the high voltage; and a ring of stainless steel wire (0.015 inches in diameter) is surrounding the “hot” electrode at its midpoint and is grounded.

At this stage of development, the sampler was tested in the laboratory at different charging and sampling voltages when challenged with polystyrene (PSL) particles ranging from 0.025 nm to 3 μm in diameter and at flow rates of 10 L/min and 30 L/min. Investigated sampling times ranged from 10 min to 4 hours. The sampler’s collection efficiency was determined by measuring the amount of particles deposited on the collection plate relative to the particle concentration upstream of the sampler. For the investigated particles, including the nano-sized ones, the collection efficiency was 70-90% at charging voltages of (+)5.5 kV, while collection voltage was set to (-)7 kV. Overall, PEBS showed very consistent collection efficiency (~70%) even after 4 hours of continuous operation. The use of the unique wire-to-wire charger resulted in ozone production below 10 ppb. Experiments with bioaerosol also show high collection efficiency.

9BA.2
Size Amplification and Viability Preservation of Aerosolized Virus by Batch Adiabatic-expansion for Size Intensification by Condensation (BASIC). HAORAN YU, Chang-Yu Wu, Nima Afshar-Mohajer, John Lednicky, Hugh Fan, Alexandros Theodore, Liming Dong, *University of Florida*

Pathogenic viruses transmitted in airborne routes exert serious impacts on human health, agriculture, and are of major concern for homeland security. Sampling is a critical step for risk assessment of exposure to airborne viruses. However, conventional bioaerosol sampling devices operate based on inertia of sampled aerosol and are inefficient in collecting virus aerosols because of their low inertia. In this study, a novel Batch Adiabatic Size Intensification by Condensation (BASIC) device was developed as an assisting tool for efficient sampling of aerosolized virus particles. The BASIC device enlarges virus aerosols by condensing water vapor on them; condensation occurs on the virus nuclei as the result of a rapid, adiabatic expansion in a humid environment. The physical and viable virus collection effectiveness of BASIC was optimized through sensitivity analyses of key parameters. The results of physical efficiency tests showed that compression pressure, number of compression/expansion (C/E) cycles and water temperature affected the sampling performance of both polystyrene latex (PSL) and MS2 bacteriophage aerosols, and size amplification of ~100 nm growth to > 1 micro-m was attainable under optimal conditions. Virus viability tests indicated that increased compression pressure was beneficial for the collection of viable MS2, whereas multiple C/E cycles were not. A water temperature of 40 degree C promoted viable MS2 collection, but at 60 degree C, virus inactivation occurred. In addition, viable MS2 collected by BASIC-assisted BioSampler was much higher than that collected by Biosampler alone. In conclusion, this device is efficient for the collection of viable virus from aerosols.