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Microbiology Laboratories

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Sarah Haines, PhD

University of Toronto

The Puzzle of Buildings & Health; Research to Practice;

This week on IAQradio+ we welcomed Dr. Sarah Haines of the University of Toronto Department of Civil & Mineral Engineering. Dr. Haines came to our attention when she was part of a group with Karen Dannemiller, PhD at the Healthy Buildings Summit 2019. It was refreshing to have a group of young academics join us to share interests in healthy buildings research to practice. She has since taken a position at the University of Toronto with Jeff Siegel, PhD another HBS Keynoter and research to practice enthusiast. This week we learned more about how Sarah and other academics see the puzzle of buildings and health.

Professor Sarah Haines interdisciplinary research integrates building science, engineering, and microbiology to analyze the impact built environment has on human health. She uses cutting-edge microbiology techniques such as next-generation sequencing, metatranscriptomics, and bioinformatics to understand the impact of weatherization and extreme weather events on indoor air quality, particularly in low-socioeconomic status communities who may be at higher risk for asthma. Her work aids in understanding indoor exposures from microorganisms and chemicals providing for a cleaner and sustainable indoor environment. Her PhD is in Environmental Science from Ohio State University.

Nuggets mined from today's show:

According to Sarah, outdoor air quality is a greater concern to people than indoor air quality.

As an undergrad at Ohio State, Sarah started doing research on air quality outdoors. The fact that the majority of our time is spent indoors, piqued her interest in indoor environmental quality.

Building Science study is big in Canada. Energy, HVAC, health exposures are some of the current areas of interest. Dr. Jeff Siegel, PhD, with whom she previously collaborated is also at the University of Toronto in the Bldg. Science Group.

Covid raised interest in indoor environmental quality (related to indoor air & indoor virus) which resulted in more funding opportunities, which resulted in a growing number of funding seekers. Seeking funding has become much, much more competitive.

During Covid, the medical community was stuck on 5 micron size particles and fomites and didn't understand that Covid was spread as an aerosol.

At Ohio State, working under Karen Dannemiller, PhD; Sarah began researching microbes on carpet and drywall and the related human exposures when moisture was elevated. Dr. Dannemiller's research is rooted in damp building material research.

Currently, most wall-to-wall is made from synthetic plastic fibers (e.g. nylon, polyester, olefin, etc.). Under high magnification these synthetic fibers appear smooth while wool (a natural fiber) appears scaly. Sarah has learned that microbes are abundant in settled dust and when moisture is elevated, microbial growth amplifies.

Sarah has learned that resuspension of settled dust from carpeting in humid environments is a pathway for human exposure to microbes and their byproducts indoors. By collecting sections of old carpets and exposing samples to raised humidity she studies the effect of microclimates on microbial amplification.

Climate change and related increase in rainfall and floods will result in more wetted building materials indoors. Moisture problems indoors is a growing problem.

She showed viewers some phenomenal photos of carpets at 50% ERH and at 80% ERH. Through this work Sarah found that microbial growth in carpet dust may be sustained even after 6 hours of exposure to elevated relative humidity. Sarah also studies the gene expression of microbes and determined that after exposure to high humidity, genes within microbes get excited and gene expression is stimulated. She has research interests in: the interaction between bacteria & fungi (symbiotic/antagonistic) and the role of beneficial microorganisms (preventing allergy and asthma).

Sarah has concerns about some efforts to salvage wet carpets indoors.

Sarah is an advocate for-Equitable, Sustainable, Indoor Environments.

Building and Environment Article-
She used a proton-transfer-reaction time-of-flight mass spectrometer (PTR-ToF-MS) to study dusty carpet and drywall in humid environments. The experiment pushed air into and out of jars holding the samples while measurements (sniffing for VOCs) were made in real time. The study found that more nitrogen was released when the humidity fluctuated up and down (50%-85%) than when it remained consistent. The study was done at U.C. Berkeley.

“Proton-transfer-reaction mass spectrometry (PTR-MS) is an analytical chemistry technique that uses gas phase hydronium reagent ions which are produced in an ion source. PTR-MS is used for online monitoring of volatile organic compounds (VOCs) in ambient air and was developed in 1995 by scientists at the Institut für Ionenphysik at the Leopold-Franzens University in Innsbruck, Austria.” - Wilkipedia

All dust is not created equal. Airborne dust differs from settled dust. Sarah is doing a forensic filter study of airborne dust.

Like just about everyone else, Sarah was spraying disinfectant all over her home to combat Covid. Covid has made her more mindful that we shouldn’t continue trying to indiscriminately kill all microbes indoors.

Some things on Sarah’s mind: Why are microbes doing when they express genes? What are microbes releasing?

Sarah is excited about working with working with communities with mold and moisture issues.

Z-Man signing off

Vishniacozyma victoriae (syn. Cryptococcus victoriae) in the homes of asthmatic and non-asthmatic children in New York City - Journal of Exposure Science & Environmental Epidemiology (Rush)

TRIVIA-
Name the winner of ½ of a Noble Prize in Physiology who later coined the term microbiota?

Answer: Joshua Lederberg
Answered by: Vic Cafaro