Studying the 5 second rule, antibiotic resistance genes in indoor dust and sewers, Legionella in the air, and water treatment.

Microbes on the floor

Longer Contact Times Increase Cross-Contamination of Enterobacter aerogenes from Surfaces to Food — Robyn C. Miranda — Applied and Environmental Microbiology ($25 for 1 day)

Bacterial cross-contamination from surfaces to food can contribute to foodborne disease. The cross-contamination rate of Enterobacter aerogenes was evaluated on household surfaces using scenarios that differed by surface type, food type, contact time (<1, 5, 30 and 300 s), and inoculum matrix (tryptic soy broth or peptone buffer). The surfaces used were stainless steel, tile, wood and carpet. The food types were watermelon, bread, bread with butter and gummy candy. (…) Contact time, food and surface type all had a highly significant effect on log % transfer of bacteria. (…) More bacteria transferred to watermelon relative to other foods, while fewer bacteria transferred to gummy candy. Transfer of bacteria to bread and bread with butter were similar, and transfer rates under a given set of condition were more variable compared with watermelon and gummy candy.

Press (note how headlines vary in their interpretation of the study!)

- Researchers debunk ‘five-second rule’: Eating food off the floor isn’t safe. Sometimes in bacteria transfer in less than a second — Science Daily
- Study: Five-second rule is too generous for fallen food— Washington Post
- Why The Five-Second Rule Is ‘Sort Of’ Right. It’s all about the kind of food and the kind of floor— David Freeman – Huffngton Post
- Forget the ‘five-second rule’: Food dropped on the floor picks up bacteria in just ONE in second— David Gardner — Daily Mail
It’s official: The five-second rule is down for the count. In most thorough debunking yet, the principle but not the rule stands test of time — Beth Mole — Ars Technica

Microbes in indoor dust

Antimicrobial Chemicals Are Associated with Elevated Antibiotic Resistance Genes in the Indoor Dust Microbiome — Erica M. Hartmann — Environmental Science & Technology (currently $40 for 2 days, but soon to be OA — email the authors)

GRAPHICAL ABSTRACT

(...) Here, we explore the relationship between antibiotic resistance genes and the antimicrobial chemicals triclosan, triclocarban, and methyl-, ethyl-, propyl-, and butylparaben in the dust microbiome. Dust samples from a mixed-use athletic and educational facility were subjected to microbial and chemical analyses using a combination of 16S rRNA amplicon sequencing, shotgun metagenome sequencing, and liquid chromatography tandem mass spectrometry. (…) We observed six significant positive associations between the concentration of an antimicrobial chemical and the relative abundance of an antibiotic resistance gene, including one between the ubiquitous antimicrobial triclosan and erm(X), a 23S rRNA methyltransferase implicated in resistance to several antibiotics. This study is the first to look for an association between antibiotic resistance genes and antimicrobial chemicals in dust.

Press:

- Antibacterial ingredients in indoor dust could contribute to antibiotic resistance — Science Daily
- Antibiotic Resistance Genes in Indoor Dust — Technology Networks
- Antimicrobial chemicals in indoor dust associated with higher count of antibiotic-resistance genes — Arizona State University
- Antibacterial Ingredients in Indoor Dust Linked to Antibiotic Resistance — ASQ

Microbes in the air

Unfortunately, no figures included of the microscopic evidence. Aerobiology of the built environment: Synergy between Legionella and fungi — Absar Alum — American Journal of Infection Control (OA)

ULTRAVIOLET DISINFECTION OF SINGLE CELLS OF LEGIONELLA AND COCULTURE WITH FUNGI

The modern built environment (BE) design creates unique ecological niches ideal for the survival and mutual interaction of microbial communities. This investigation focused on the synergistic relations between Legionella and the fungal species commonly found in BEs and the impact of these synergistic relationships on the survival and transmission of Legionella. A field study was conducted to identify the types and concentrations of fungi in BEs. The fungal isolates purified from BEs were cocultured with Legionella to study their synergistic association. (...) The microscopic observations of Legionella internalization in fungal hyphae were confirmed by molecular analyses. (...) This study provides the
first evidence, to our knowledge, of Legionella cell presence inside fungi detected in an indoor environment. This symbiotic relationship with fungi results in longer survival of Legionella under ambient conditions and provides protection against UV rays.

Review: Generic aspects of the airborne spread of human pathogens indoors and emerging air decontamination technologies – M. Khalid Ijaz – American Journal of Infection Control (OA)

Sources of airborne pathogens indoors and potential for environmental surface contamination

Indoor air can be an important vehicle for a variety of human pathogens. This review provides examples of airborne transmission of infectious agents from experimental and field studies and discusses how airborne pathogens can contaminate other parts of the environment to give rise to secondary vehicles leading air-surface-air nexus with possible transmission to susceptible hosts. The following groups of human pathogens are covered because of their known or potential airborne spread: vegetative bacteria (staphylococci and legionellae), fungi (Aspergillus, Penicillium, and Cladosporium spp and Stachybotrys chartarum), enteric viruses (noroviruses and rotaviruses), respiratory viruses (influenza and coronaviruses), mycobacteria (tuberculous and nontuberculous), and bacterial spore formers (Clostridium difficile and Bacillus anthracis). An overview of methods for experimentally generating and recovering airborne human pathogens is included, along with a discussion of factors that influence microbial survival in indoor air. (…)

Microbes, antibiotics, and wastewater treatment

Emerging Investigators Series: Sewer surveillance for monitoring antibiotic use and prevalence of antibiotic resistance: urban sewer epidemiology – Nicole Fahrenfeld – Environmental Science: Water Research & Technology (free with registration)

Graphical abstract

Sewer surveillance may be a useful tool for epidemiology that would benefit from improved understanding of the fate of microbial agents and prescription antibiotics during conveyance in sewer systems. The aim of this review is to provide an overview of the factors affecting the loading and fate of antibiotics and antibiotic resistant bacteria (ARB) in sewer systems. A review of surveillance studies for antibiotics and antibiotic resistant bacteria is presented. Then, the role of potentially complicating sewer inputs (e.g., the presence of health care facilities in a sewershed), and evidence for temporal variations in antibiotics and ARB are reviewed. Recommendations for best practices for sampling are made. Finally, evidence is presented for in-sewer attenuation of antibiotics and attenuation, growth and gene transfer for ARB. (…)

Microbes in water supply chain

A modified weighted mixture model for the interpretation of spatial and temporal changes in the
microbial communities in drinking water reservoirs using compositional phospholipid fatty acid data – I. Stanimirova – Talanta ($41.95)

GRAPHICAL ABSTRACT

The aim of this work was to check whether a methodology based on the analysis of data that contain the entire phospholipid fatty acid, PLFA, compositions of water samples can be successfully used to interpret spatial and temporal changes in the microbial communities in water reservoirs. (…) A 16S rDNA analysis of some of the selected water samples in the monitoring campaign was performed in order to verify the results of the PLFA analysis. The results showed that the proposed methodology can be useful for a dynamic and sensitive evaluation of changes in the microbial quality of water before and after flash flooding and can help in taking a decision regarding further risk assessment.

Point-of-use Unit Based on Gravity Ultrafiltration Removes Waterborne Gastrointestinal Pathogens from Untreated Water Sources in Rural Communities – Cristóbal Chaidez – Wilderness & Environmental Medicine ($35.95)

GRAVITY-FED WATER PURIFIER, SPORTSMANS GUIDE

In developing countries, rural communities often face the lack of potable water infrastructure and must rely on untreated sources for drinking, which are often contaminated with waterborne pathogens. The use of home water treatment devices is seen as one means of reducing the risk of exposure to waterborne pathogens. The aim of this study was to evaluate the microbiological and physicochemical performance of a simple in-home point-of-use device based on gravity ultrafiltration through an ultrafilter membrane. Twenty-five randomly selected households from 2 rural communities in Culiacán, Mexico, were enrolled. (…) This study demonstrated that point-of-use filters using gravity-fed ultrafilters are a low-cost, effective water treatment technology for water of poor microbial quality.