

## FAQ -

### Why are we doing this study?

This project is part of a larger study funded by the Alfred P. Sloan Foundation to examine the microbiology of the human environment. We are looking at the microbiology of air and water in homes, schools, and public buildings. The microbial community in these environments is largely unknown - earlier studies depended on culture, which only identifies about 1% of the organisms in any given environment. We identify the organisms through their DNA, essentially using the DNA as a barcode. This provides a previously unavailable sketch of which microbes we all interact with on a daily basis.

### How did this study begin?

This study is part of an ongoing research project to understand the microbiology of water systems. We previously have studied a number of human-related environments, for example: municipal waters, swimming pools and shower curtains. This particular study began as a class project in University of Colorado, Boulder MCDB 4110, Molecular Methods, a senior-level research class. The students performed the baseline study, and the results were sufficiently interesting to warrant further investigation.

### What did this study entail?

This study entailed sampling of 45 showerhead sites in the U.S.. Major sampling campaigns were conducted in New York and Denver metropolitan areas. Several sites were sampled on multiple occasions to test the changes in microbial communities over time. DNA was used to identify the microbial communities. Additionally, the analysis included quantitative PCR analyses, which allows us to specifically detect single species (in this case *M. avium*). Microscopy was also conducted.

### What part of the showerhead did you sample? How?

We removed the showerhead from the pipe and sampled inside the showerhead along the water flow path. We rubbed a swab along the inside of the shower and extracted the DNA from that swab. Additionally, we sampled water flowing from the showerhead (before sampling inside the showerhead) and from the pipe with no showerhead installed.

### Is it dangerous to take a shower?

No. We did see some organisms that might be of concern if you have immune issues (have cystic fibrosis, AIDS, recent organ transplant, substance abuse, or are pregnant or otherwise immune compromised). The main organism of concern was *Mycobacterium avium*, which is a relative of the organism that causes tuberculosis (*Mycobacterium tuberculosis*). *M. avium* infections are on the rise, and some experts have hypothesized that this is related to the greater number of people taking showers instead of baths. *M. avium* infections are not well documented because they are not reported to the CDC, but are known to be more prevalent than *M. tuberculosis* infections in developed nations.

### Was *M. avium* observed everywhere?

No, well water supplied homes did not have mycobacteria in their showerheads. *Mycobacterium avium*, specifically, was only observed in two of the well-sampled metropolises: New York and Denver. All municipalities had mycobacterial species, but not all had *M. avium*. Their presence in municipal water/showers may be caused by the chlorine-resistance of mycobacteria, which allows them to survive municipal water treatment procedures. Also, *M. avium* is a common environmental organism that lives in soil (including potting soils, as we and others have shown).

If *M. avium* is common in the environment, why are showerheads an issue?

Showerheads deliver the microorganisms as aerosols, which are inhaled. Many of the aerosol particles are small enough to penetrate the deep airways of the lungs. The fact that *M. avium* is dominant in the showerhead biofilms indicates that it is delivered in aerosols, and indeed we detect that. In contrast to showers, bathing creates little aerosol.

What are the symptoms of *M. avium* infection?

*M. avium* is primarily a pulmonary pathogen, causing disease of the lungs, but it has also been known to cause infections in other regions such as the digestive and lymphatic systems. *M. avium* pulmonary infection symptoms are similar to those of tuberculosis and usually include a chronic shallow cough, fever, fatigue and weight loss. *M. avium* can not be transmitted from person to person. It can only be acquired through environmental exposure. In persons with healthy immune systems, *M. avium* infection is rarely a concern, and most people are exposed to this microbe without development of symptoms. Unfortunately, in those with underlying immune problems, *M. avium* can cause severe illness requiring antibiotic treatment.

How should I clean my showerhead?

Showerheads are full of nooks and crannies that provide an ideal home for bacteria and other microbes. This also makes them very hard to clean, and products with bleach remove many microbes, but mycobacteria grow back (and chlorination does not keep them out). For most people, this is not really a concern (see "Is it dangerous to take a shower?"). If you are immune compromised, you might want to consider changing out your showerhead regularly. Additionally, microbes attach more easily to plastics than metal - if you are concerned, you may want to hunt down an all-metal (not metal-coated plastic) showerhead.

Can I do this at home?

Not cheaply. DNA is extracted from the showerhead swab or water samples and then copied, isolated, and sequenced. Sequencing costs a few hundred dollars per sample, above and beyond the sampling, preparation, and equipment costs and required expertise.