

Improve the ventilation, even spread some good germs. If you want people to be healthy and productive, tend the microbiome. By Caroline Winter

Four years ago, a doctoral student in architecture asked Luke Leung to help him come up with a thesis topic. Leung, an engineer whose projects include the world's tallest building, the [Burj Khalifa](#) in Dubai, proposed the question: What is heaven?

"The student did a lot of research and found that no matter the faith—Islam, Judaism, Christianity—heaven is always a place with a garden and running water," recalls Leung, director of the sustainable engineering studio of [Skidmore Owings & Merrill](#), the architectural behemoth better known as SOM. "So then we started questioning, 'If that is heaven, what exactly is the place we are living in?'"

In the Western world, humans spend 90% of their time indoors.

For years scientists have sounded the alarm that our disconnect from the outdoors is linked to a host of chronic health problems, including allergies, asthma, depression, irritable bowel syndrome, and obesity. More recently, experts in various fields have begun studying why buildings, even those designed to be as germ-free as possible, are vectors for disease, not the least Covid-19.

A "misalignment with nature" in building design is partly to blame for our scourge of chronic diseases and the current pandemic. The relative lack of air flow and sunlight is an obvious issue; temperature, humidity, and indoor air pollution also play a role. But there's another, less discussed factor: **the microbiome of the built environment, which encompasses trillions of microbes including bacteria, fungi, and viruses.**

The term "microbiome" is most often used to refer to the population of microbes that inhabit our body, many of which help produce vitamins, hormones, and other chemicals vital to our immune system, metabolism, mood, and much more. Like our bodies, the buildings we inhabit are also teeming with microbes. In recent decades our personal microbiomes have been altered by factors such as poor dietary habits, a rise in caesarean-section births, **over prescription of antibiotics, overuse of disinfectants** and other germ fighters, and dwindling contact with beneficial microbes on animals and in nature.

With each breath you bring oxygen deep into the alveoli of your lungs, along with hundreds or thousands of species. Each place you sit you are surrounded by a floating, leaping, crawling circus of thousands of species. Over time these many microbes have adapted to survive, and even thrive, everywhere from our pillowcases and toothbrushes to the more extreme climates of our dishwashers, showerheads, ovens, and freezers. Many are derived from humans, or likely feed off human debris. More species of bacteria have been found in homes than there are species of birds and mammals on Earth

The most urgent microbe-related question is SARS-CoV-2 and how to kill it. Beyond that, there are also long-term questions. **How can we promote indoor microbe populations that don't make us chronically ill or harbor deadly pathogens?** Can we actually cultivate beneficial microbes in our buildings the way a farmer cultivates a field? Experts including Kevin Van den Wymelenberg director of the Biology and the Built Environment Center at the University of Oregon, are confident all this is possible.

A more serious risk is that attempts to sterilize our surroundings can kill off bacteria critical for human health—or, even worse, inadvertently promote the survival and evolution of more dangerous bugs, including antibiotic-resistant superbugs. A study from the Department of Homeland Security found that the coronavirus can hang around indoors in the dark for hours. Facing an invisible and potentially deadly virus, the understandable impulse has been to whip out some Clorox and go to battle. But indiscriminate bleach-bombing could backfire.

“We should be worried,” says Rob Knight, founding director of the Center for Microbiome Innovation and a professor of pediatrics at UCSD. “If we’re overzealously stripping off all the bacteria that would naturally be there, then we may be creating homes for bacteria and maybe even viruses that are harder to remove.” No amount of chemicals will get rid of everything, and what’s left behind is often undesirable.

“The more we use the same antimicrobials in different contexts, the more opportunity these microbes have to develop resistance,” says Erica Hartmann, an engineering professor at Northwestern University who focuses on indoor microbiology and chemistry. Given the horrors of Covid, many businesses and building managers will also work their hardest to sanitize indoor environments like never before, perhaps causing unintended consequences.

Wiping out good bacteria along with the bad has also been linked to chronic health problems.

Our pandemic-era anti-germ crusade may not have a big impact on the already formed microbiomes of adults. But infants and young children, who need exposure to a wide variety of microbes to train their developing immune systems, could be more adversely affected.

All this means indoor air is often far worse than outdoor air, with levels of some contaminants rising to 10 times higher or more.

Going a step further, scientists are studying whether salubrious environmental microbes can be introduced into urban homes to reduce the prevalence of inflammatory diseases. A number of start-ups are marketing bacteria sprays for homes and businesses. Belgium-based TakeAir advertises an “air enricher” that disperses soil- and ocean-derived microbes through existing ventilation systems to create “a 100% natural and protective biosphere for your building users.” Clients include a Belgian chain of gyms and a housing project in Antwerp. Another front-runner, **Betterair** in Israel, sells “the world’s first organic air and surface probiotic.

“It’s only a matter of time before these technologies become better understood and more widespread”, says Jack Gilbert, a professor and microbiome researcher at the University of California at San Diego. “We’ve created buildings so sterile that now we have to buy nature and spray it back in. That’s how silly we are.” says Luke Leung, an engineer whose projects include the world’s tallest building, the [Burj Khalifa](#) in Dubai. Perhaps the pandemic will serve as a wake-up call. “This is our chance to right our wrongs of the past 200 years,” he says.

**The above are excerpts from the extended article published December 23 , 2020 on Bloomberg Businessweek The content has not been altered and all is quoted verbatim; below is the link to the full article <https://www.bloomberg.com/news/features/2020-12-16/covid-pandemic-microbiomes-could-be-key-to-stopping-spread-of-future-viruses>*