

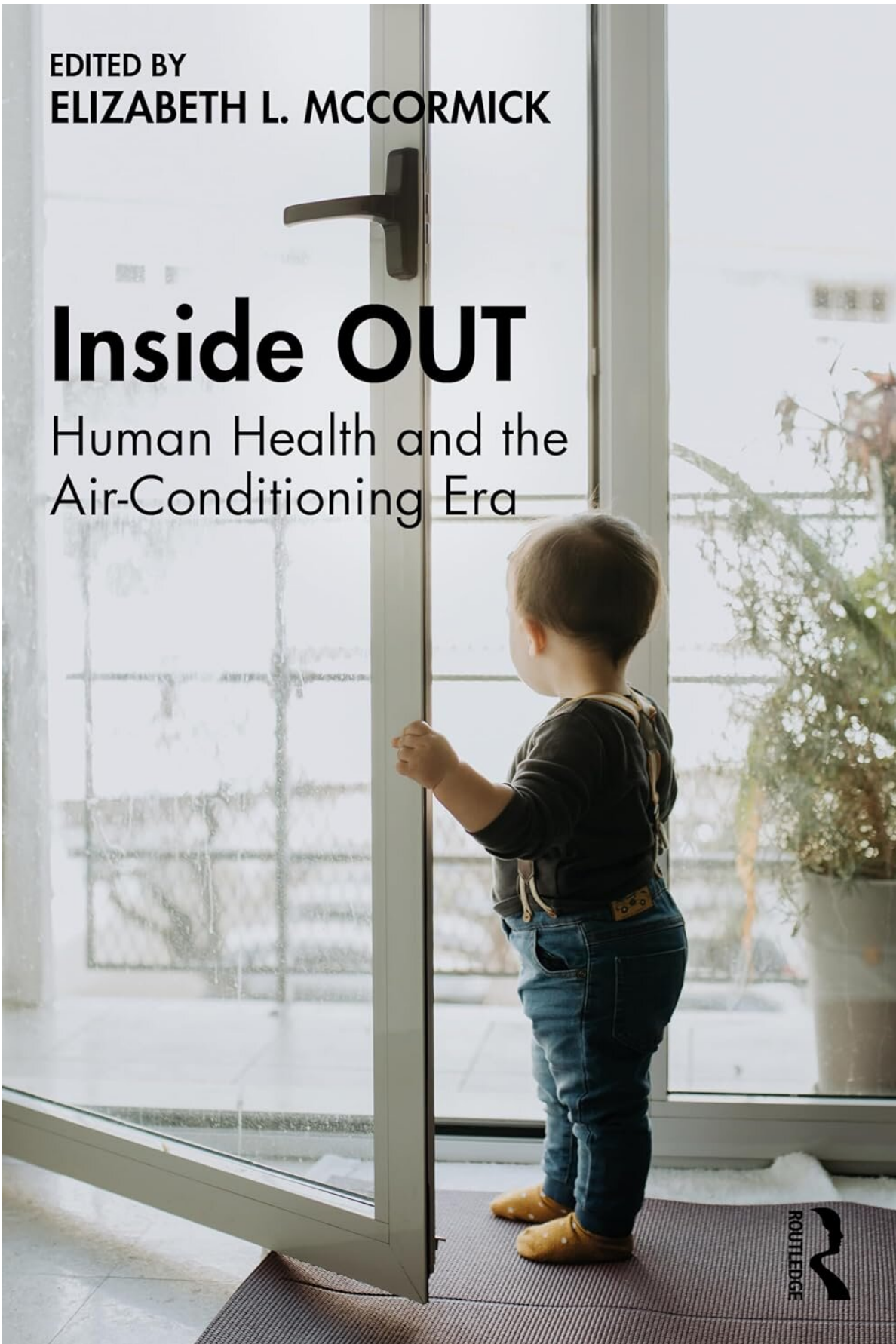
Could a probiotic for your house help to prevent asthma and keep illness at bay?

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Inside OUT

Human Health and the
Air-Conditioning Era



Credit: Routledge

Homes have become 'too clean' and could benefit from the introduction of 'healthy germs' which introduce friendly bacteria to potentially stave off a host of childhood illnesses, including asthma, experts suggest.

Elizabeth McCormick, Assistant Professor of Architecture and Building Technology at the University of North Carolina at Charlotte School of Architecture, suggests the tendency to kill all germs means that [beneficial bacteria](#) in homes and buildings are also eradicated.

With the average person spending more time indoors than ever before, McCormick suggests researchers need to focus on finding way to introduce healthy germs to homes in new book "Inside OUT: Human Health and the Air-Conditioning Era."

What is the hygiene hypothesis?

According to a report from the US EPA, Americans spend 90% of their time indoors, but McCormick points to an emergence of research in the last half-century which suggests often these spaces have become "too clean."

"Advertisements for [hand soaps](#) and detergents, for example, underscored the fear of germs, while advertisements for prescription drugs also emphasized visual representations of germs," she explains. "Ultimately, the realization that diseases could be spread through human transmission, not environmental conditions, induced a culture of excessive cleanliness and urban germaphobia."

This theory, known as the "[hygiene hypothesis](#)," is one explanation used by scientists for the dramatic increases in childhood illnesses and [microbial resistance](#) to antibiotics.

"In designing 'healthy' buildings, the discourse has revolved around the total elimination of microbial communities, which eliminates organisms that are both non-pathogenic and necessary for healthy and robust immune function," she explains. "This microbial network is an inevitable and essential component of both human and non-human life; however, buildings often neglect this notion, instead opting for sterile, antiseptic interior spaces."

What are healthy germs?

Microorganisms are everywhere: outside, in soil, on plants, in the food we eat, in animals, in and on our bodies, on surfaces, and in our homes. While microorganisms are sometimes seen as harmful contaminants, something to remove from our homes and spaces using anti-microbial soaps and cleaners, these microorganisms serve numerous beneficial purposes in our everyday lives, from contributing to the human immune system to maintaining soil health.

McCormick explains that homes and buildings also have unique ecosystems, and a growing body of research is emerging which proposes a "probiotic approach" to architecture.

"In true antibiotic fashion, the discourse surrounding the modern approach to 'healthy' buildings has revolved around the total elimination of microbial communities, which eliminates organisms that are both non-pathogenic and necessary for healthy and robust immune function," she explains. "Certain levels of microbial exposure are fundamental to human health."

According to the "hygiene hypothesis," overly clean environments fail to provide necessary exposures to microorganisms to educate our immune systems so that our bodies can respond to infectious organisms.

"Exposure to a diverse set of microorganisms at a young age has been associated with decreased asthma risk; however, it is not clear if only diversity is needed or whether a specific microbial community made up of a beneficial mixture is required," she explains. "For example, studies have shown how childhood exposure to dogs is associated with a decreased risk of allergies and asthma."

Medical and scientific researchers are exploring whether targeted hygiene is more effective to manage microbial diversity, in place of indiscriminate sterilization procedures.

What about indoor air quality?

In our built environment, we are consistently exposed to a variety of chemical pollutants, particulate matter, and microorganisms. Sources of indoor microorganisms include humans, plants, pets, plumbing, [air conditioning](#), and the outdoor environment.

As well as issues around eradicating healthy bacteria with over-cleanliness, McCormick also discusses how indoor pollutants can cause more damage to the human body than [outdoor air pollution](#).

"It's possible, and even likely, that the air in the middle of a busy intersection might actually be cleaner than the air in your living room right now," she explains. "However, most Americans still perceive the risks of outdoor air pollution as being substantially higher than the threat of indoor air, even though dangers posed by long-term exposure to unhealthy indoor air have become more apparent in recent years, particularly for people who suffer from allergies and asthma, as well as

children and the elderly. Allergies are increasing across the globe, but more so in the developed world due to chemical exposures in low-quality indoor air."

A [meta-analysis](#) of more than 40 studies published between 1977 and 2013 found that children living in homes with gas stoves had a 42% increased risk of having childhood asthma and a 24% increased risk of lifetime asthma.

Despite these findings, there is not a full national accounting of asthma triggers, so it is still difficult to compare against the health threats of other indoor pollutants. "Despite mounting data about the invisible enemy lurking inside our buildings, indoor air pollution remains largely unregulated in the United States."

Researchers have determined that both the ventilation source (dispersal of outside organisms indoors) and the conditions within the building (temperature, relative humidity, floor type, and space type) contributed to the indoor microbiome.

What can be done about it?

While there are some changes people can make at a household level, including regularly ventilating spaces and not over-cleaning, the authors say much more could be done and are pushing for greater focus from policymakers and researchers to drive current understanding forward.

For example, McCormick points out that although ambient air pollution has been federally regulated in the United States for more than 50 years, there are still no federal laws to protect indoor air.

While an obvious solution would be to improve ventilation in buildings—enhancing access to outdoor air while maintaining an

appropriate level of human control—increasing ventilation rates to the levels necessary to create a healthy building would have tremendous impacts on energy consumption.

"While many technologies can improve [indoor air quality](#), a techno-centric approach will not challenge our relationship with isolated conditioned environments," McCormick explains. "Mechanical conditioning could lead to excessive energy consumption, carbon emissions, and expansive ecological degradation."

McCormick and co-authors hope to promote design changes that purposefully increase biodiversity and encourage more creative solutions that don't rely exclusively on technology.

"The human relationship with dirt, germs, and cleanliness is actually a relatively new construct that stems from social theories of health and hygiene. Because of the close associations between sociocultural constructs and technological development, truly healthy buildings must embrace both technology and human behavior concurrently," she explains.

McCormick posits that one such creative solution in the future could be to "seed" indoor microbiomes with probiotics (beneficial microorganisms) to enhance overall [human health](#). One vision is seeding materials in indoor spaces with these beneficial organisms and ideally positively changing the overall microbiome.

In the immediate term, McCormick says much more work is needed to determine the right balance of too much and too little indoor microbial exposures, as there is clear evidence that certain microbial exposures have beneficial health implications.

More information: Elizabeth McCormick, Inside OUT (2024). [DOI:](#)

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