SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

The objective of this study was to develop an understanding of the influence of design choices on the biogeography of the built environment microbiome and to answer the following questions:

- At the scale of the building do form, function, and organization predict the variation in the built environment microbiome?
- For rooms that are the same type of space, which aspects of form and organization most influence the built environment microbiome?

Architectural Design Drives the Biogeography of Indoor Bacterial Communities

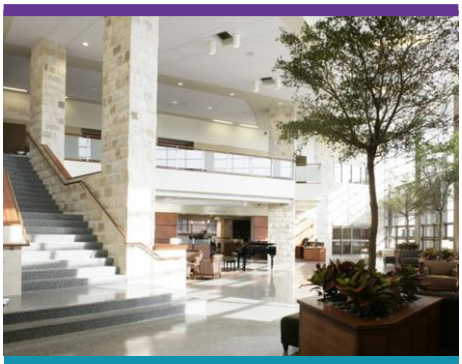
Kembel, S. W., Meadow, J. F., O'Connor, T. K., Mhuireach, G., Northcutt, D., Kline, J., ... & Green, J. L. 2014 | *PLoS One*. Volume 9, Issue 1, Pages e87093

Key Concepts/Context

Human beings spend a substantial portion of their time in buildings that are complex ecosystems for microorganisms. Humans come in contact with the built environment microbiome (the microbial communities within buildings) which have the potential to affect their health. The authors suggest that the built environment microbiome can be modified through design to ultimately influence human health. The authors collected microbiological, architectural, and environmental data from different sites in a building. The study found that the type of space influences the variation in microorganisms in the entire building.

Methods

This study involved the microbiological analysis of bacterial communities in dust samples that were collected from 155 sites in a four-story classroom-cum-office building in a university in Oregon, USA over a period of three days in June 2012. Data on the architectural design attributes of the building were collected from plans, field observation, and building information model. The spaces in this building were classified on the basis of human-use patterns – circulation (hallways, atria), classrooms, classroom support (reading and practice rooms), offices, office support (storage, conference rooms), building support (mechanical equipment room, janitor's closet), and restrooms. In addition to its level, wing, and size, the air handling unit for each of these spaces and a qualitative assessment of human diversity and annual occupied hours in these spaces were also measured. Environmental data collected included temperature and relative humidity. Bacterial communities from the dust samples were profiled and subjected to sequence processing. The data were subjected to statistical analyses and network analysis.



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Findings

- The study found that the dust taken from different sites in the building had very diverse bacterial communities. Yet there were certain types of bacteria that were found in every dust sample.
- Spaces with different design characteristics had distinctive bacterial communities. Biological similarity of bacteria decreased as one moved away from one space to another.
- Bacterial communities varied by the type of space and had a strong correlation with human occupancy and how well connected that space was.
- The bacteria in the faculty offices that were window ventilated were different from those in offices that were mechanically ventilated.
- The bacteria found in the samples taken from sites in the restroom were distinctly different from the bacterial communities found in other sites.

Limitations

The authors do not mention any limitations to this study. Although the following points may not have been limitations to the study, such information would have helped a broader understanding:

- There was no mention if the microbes identified impacted human health.
- Time, in terms of season, day, and week was not indicated – this may have indicated the human traffic in the buildings studied and also the extent of window ventilation given the season.

Design Implications

Authors indicate that the indoor microbial community (in size and diversity) is influenced by design choices. They cite literature where it is shown that microbial biodiversity is linked to human health and well-being. This study shows spaces that are well-connected, have more human traffic, and are window-ventilated had the most microbial diversity. However, further studies are recommended by the authors to study the interaction between the human microbiome and the built environment microbiome before design choices can be made on the basis of this study.

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