

The indoor Biosphere as the preparation for the next generation-built environment

Definition of a biosphere

- 1: the part of the world in which life can exist
- 2: living organisms together with their environment

The 20th century has given us the built environment of today. Ventilation and filtration practices, energy efficiency, smart materials, sustainable practices, thermal and acoustic comfort. We present in this paper the next stage for the built environment, a 21st-century ecosystem service. TakeAir presents the Indoor Biosphere.

We still live in the buildings and with the technology of the 20th century ... That's perhaps one of the reasons we are not prepared for a 21st-century pandemic

The purpose that we use such a biological word, the Biosphere, is that we believe that the microbial design and technological performance of the indoor environment are the driving forces for human health in the built environment. It is the technological advancement that brought us here. It is the microbial evolution that made us who we are.

By tending the microbial environment, we are becoming masters of the smallest matter. We are using microorganisms that we only know existed a few years ago. We use these organisms in our BioTech management systems as they are the earliest building blocks from which all life spawned (Archeae bacteria, meaning primal bacteria). Where we before needed heavy industrialized chemical agents, we now need a small number of organisms to spread out and occupy the room, so dominant pathogens can't roam free anymore. Targeted hygiene instead of mass sterilizing and disinfecting. There is no waste in this process, no heavy industry machinery or ecological cost in producing these organisms [\[1\]](#).

When you walk into a forest it just does its foresty things - you don't have to turn on the tui, or plug in the kauri tree, you just stand there as an organic thing, being of the forest. This is where we'll have to see our built environments go.

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This principle should be mass applied to our indoor environment. Just by walking in, you should already feel better, healthier and happier! We are starting this journey with the help of BioTech Management systems. These are form-based, not information-based. It does not solely describe the status of the indoor environment as a status quo. It is a precursor on how the environment is constantly changing and improving if the right actions are undertaken. Very soon, it will become clear that the user is in control. When given the right information he will assess and take control of that form.

After crisis comes opportunity

Why does all this matter? The beginning of the '20s in the 21st century thought us a harsh lesson: the tiniest living organisms that humankind hosts can make a world-changing impact. The acknowledgement that Covid-19 is airborne transmissible has brought forth an irreversible radical paradigm shift. We know that what we can't see can have the greatest impact. The future is microbial.

The Spanish flu pandemic of the 20th century changed healthcare drastically. Some embraced science, others turned away from it[2]. Today that question is irrelevant, we now must answer if we embrace our shared responsibility. We have the science and the choice to control, advert, and measure future outbreaks. It is only by choice that we would do nothing.

National healthcare systems are put under a huge amount of stress, cost and human capital in mitigating and intercepting such dramatic events. If we share the burden and focus on structural solutions we create a more resilient and stronger future for everyone.

Covid-19 is boosting collective health management mechanics towards society, everybody must contribute. The buildings we visit and live in have that same responsibility. We cannot allow them to make us sick. Conventional practices have failed to meet this responsibility, now we have a choice to do better. The philosophy of the indoor Biosphere is that we can constantly build on improvement and generate the best conditions, even when under attack from outside sources.

Looking at the indoor environment as a Biosphere asserts that a high-performance building is breathing, it can get sick, but it can also become stronger, more resilient. We acknowledge that the indoor environment should be adaptable and able to respond to disasters both natural and man-made, be it a global health pandemic or the incorrect implementation of environmental services. By connecting hospitality and sustainability a strategy is presented for decades to come.

The Biosphere is a radical paradigm shift where we connect all living mechanisms with the environment in which it is hosted. The air we breathe not as a statistic neutral force, but as a driving positive force in preparation for the nascent next-generation health society.

Escalation and endurance.

After danger comes opportunity, but what if a global pandemic is the least possible danger? The 6th ICPC report does not bring good news for another shared responsibility, our climate. The global crisis continues to press our beliefs and question our ways. The direct and indirect consequences of climate change are having an impact on our indoor environment and personal health today[3]!

Increased incidence of extreme temperature as in North America and Europe will change loads on HVAC systems, demanding more energy consumption.

Altered respiratory infectious diseases will be the result of a hotter climate stressing our built environment and HVAC systems even more.

Escalating and enduring droughts, wildfires and changes in irrigation practices will have an increased level of airborne particulates from crustal dust and combustion that will result in more respiratory distress and illness.

Outdoor pollen levels have been rising due to temperature-related changes^[4], we will see alterations in indoor allergen levels that will inflict greater harm due to the allergen mediated distresses and illnesses

Harsher climatic circumstances and disaster displacement, population growth and extreme urbanization. Global pandemics and stressed healthcare systems. This is a direct threat to our built environment if we do not act. We need to connect the dots between the air we breathe, the indoor environment and the world we live in.

Our shared opportunity to act

A global pandemic, a climate under attack, these share a common denominator: A responsibility for humankind to act. Fight the global pandemic, relieve the climate, create healthier and stronger people. The 21st century will continue to bring innovation for building physics, the biology of the built environment is only the continuation of that path, we look for what we lost due to historical decisions.

According to a World Bank report, climate change will see more than 143 million people become “climate migrants” as they escape from crop failure, water scarcity and sea-level rise. This is going to drive immense urbanisation to 2050 which will put incredible pressure on our cities.

Working with the concept of the Biosphere is acknowledging the shared responsibility of the built environment. Towards each other and that we can use the built environment as a way forward, not tending the status quo. If we choose to break this impasse the technology, production and vision needs to be green and mean. Sustainability and a circular economy should not be implemented lightly, they break the wall and surpass expectations. Anything else is throwing us back 50 years in time. Creating awareness about this responsibility is the only way forward. It is inclusivity that will determine the grade of success.

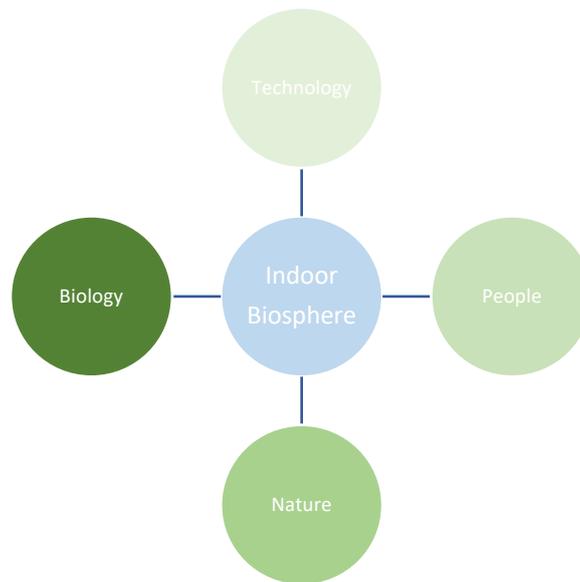
The Indoor Biosphere theory

A systemic approach to go beyond IAQ and deliver true change. Reconnect four key stewards that drive health where the indoor environment is a social-ecological catalyst.

The Ecological Biosphere is adaptive, dynamic, circular, and growing.

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The Social Biosphere is responsive, inclusive, anticipates and reflects



1. Biology of the Biosphere

Biomimicry assesses, controls, and improves the microbial landscape. Reconnect the grey mass with nature and build a resilient indoor environment.

2. Technology and the Biosphere

The lungs of your building need to work in high performance. Tracking data in the Biosphere calculates human value on which you can build

3. The climate around the Biosphere

Driving innovation is only possible when it's sustainable. Employ a vision of safe ecological limits and biobased solutions

4. People in the Biosphere

Collective & inclusive engagement to create awareness. A Biosphere strategy is always with people and for people.

The Biosphere is:

- Redefining the way, we think about the indoor built environment to better adapt to climate and urbanized changes.
- Reflecting on the ecosystems of our local indoor ecology within our urban environments
- A new opportunity to transform indoor environments in a truly vibrant and living organism. Dynamic, inclusive, and adaptive.
- Offer a vision about IAQ that is delivering innovation. Expanding our options by introducing a Biosphere that is reconnecting with nature and opening a continuation of play.
- By mimicking natural solutions, we can go beyond the human conception of how a built environment can change.

[1] <https://www.wsp.com/en-NZ/insights/building-within-the-biosphere>

[2] Laura Spinney, journalist and author of *Pale Rider: The Spanish Flu of 1918 and How It Changed the World*.

[3] Climate change, indoor environments, and health; [John D. Spengler](#)

[4] Temperature-related changes in airborne allergenic pollen abundance and seasonality across the northern hemisphere: a retrospective data analysis