

Allergy as a sentinel measure of planetary health and biodiversity loss

To the Editors,

*Disaster is possible not only
as a once-in-a-blue moon catastrophe
but as a creeping gradual thing.*

René Dubos PhD, *Horizon*, 1970

The health of human civilization is intricately connected to all aspects of our environment, with the same principals of interdependence applying on all scales—from large-scale global systems to the subcellular dynamics of each living organism. The overarching concept of “planetary health”¹ emphasizes the integration of all biological, psychological, social, and cultural aspects of health in the modern environment, and the need to address these collectively across every level. It blurs the artificial lines between health at scales of person, place, and planet, recognizing that large-scale issues—such as climate change, mass urbanization, and biodiversity losses—are reflected on the micro-ecological scale, including the personal microbiomes that are crucial for individual health.²

This year marks the 50th anniversary of the seminal Keynote lecture entitled “The Spaceship Earth” by Professor Rene Dubos to the (then) *American Academy of Allergy*,³ shortly before the first lunar landing in 1969. It was a pivotal moment, as humanity prepared for an enormous technological “step for mankind,” and the imminent rise of the environmental movement, which instantaneously galvanized after the first images of planet Earth were beamed across the void of space to a transfixed world. The photograph known as “Earthrise,” taken on the 1968 Apollo 8 mission, had already become one of the most significant images of the 20th Century—capturing the fragile complexity and miraculous beauty of our blue planet in the vastness of space (Figure 1). As we now consider the rapid-scale trajectory of the Anthropocene that was already building toward mass urbanization, and the grotesque levels of biodiversity loss we see today,⁴ it timely to be reminded of the images that triggered profound shifts in both environmental awareness and the potential for human unity.

By 1969, Dubos, a celebrated microbiologist, had already spent many years using germ-free and specific-pathogen-free murine models to clearly demonstrate the effects of stress, dietary factors, maternal care, housing conditions, social interactions, and sanitation on lifelong health—through effects on microbial ecology.^{5,6} Decades before the hygiene hypothesis gained popularity, he warned of

the long-term implications of antibiotic overuse and “sanitization,” environmental degradation, and biodiversity loss—particularly in children—on all aspects of health, as a result of “altered immune reactivity.” He even predicted a pandemic of physical and mental disease as a delayed consequence of massive urbanization, lifestyle, and environmental stress that would take generations to fully manifest—a prediction that is very much in evidence today.⁷

Allergy, he proposed, could be considered as an important sentinel measure of planetary health—altered immune reactivity, which might reflect the state of the world around us. This perspective underscores that immune health is manifest in all aspects of biophysiology not just those we have come to neatly classify as “allergic disease.” In essence, allergy and all noncommunicable diseases, including mental disorders, could be anticipated to rise as a result of adverse environmental effects on immune function, mediated at least in part through effects on microbial diversity. Much of this is proving to be correct,² as we now begin to understand the pathways of impact of the total “exposome” on health.⁷

Yet, the significance of these words was neither recognized, nor acted upon, perhaps in no small part because of the siloed inward-looking approaches of health disciplines and other professions. Fragmented approaches have allowed vested interests to flourish and sow seeds of doubt and misdirection—unchecked in a wider culture of greed and complacency. The big question now is whether we can learn from history and engage more actively as advocates for change? Whether we can step across the demarcations of our specialty to contribute to the far greater conversations that affect our future?

As immunologists and allergists, we are ideally placed to join wider conversations that affect human health and the health of our environment. Our discipline has been at the leading edge of research that has demonstrated the importance of immune health to all aspects of our health, and the critical and lasting impact of the early environment. For decades, we have also been at the forefront of global discussions on the significance of biodiversity loss for human health; experts in our field have pointed out that, despite many undeniable benefits of urbanization, there are large-scale impacts rippling through microecological scales.⁸

This has seeded concepts of “dysbiotic drift”²; that is, an articulation of why the shifting *dual* burden of progressive *increase in adversity* (pollution, environmental degradation, rapid urbanization,



FIGURE 1 “Earthrise”: Inspired by the historic photograph taken by young astronaut Bill Anders on the 1968 Apollo 8 mission including his own words of reflection as he spoke to Jim Clash at Forbes magazine, April 17, 2015. Art created by the author (SLP)

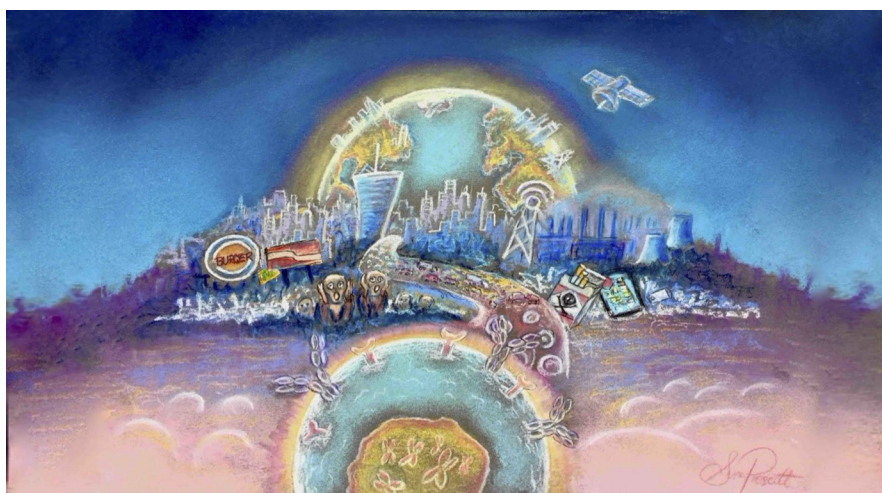


FIGURE 2 Dysbiosis means “life in distress” on every level: The drivers of inflammation and dysbiosis at the cellular level are also driving life in distress at the planetary scale. The solutions therefore require integrated multilateral mutualistic approaches that align the interests of people, place, and planet. Art created by the author (SLP)

and ultra-processed foods), magnified by the progressive loss of protective and buffering factors (nature and greenspaces, biodiversity, traditional foods, spirituality, and community cohesion), is impacting virtually all aspects of physical and mental health. Although “dysbiosis” in this context focuses on the etymological meaning of “life in distress,” it is also reflected in the dysbiosis of microbial systems that sit at the foundations of all ecosystems, including our own.⁷ This provides a direct line between “life in distress” at cellular scale and planetary scale, such that the drivers of inflammation and dysbiosis echo across every level, including the transgenerational epigenetic effects (Figure 2). It underscores the need to understand the biology of complexity, including the interdependence and interconnectivity of all systems—urging us not lose sight of the big picture as we dive into detail. It further reinforces that all our global challenges are interrelated and why multilateral solutions must supersede traditional siloed approaches—that extend beyond biology to the wider social, cultural, economic, and even spiritual, determinants of the health of person, place, and planet.²

The broad path to solving interconnected global challenges will help solve specific problems. As such, solutions to the “allergy

epidemic” must be seen as integral and inseparable other from other challenges. Conversely, what we learn through specific problems will illuminate that path, and what we are learning from allergic disease is already providing these vital clues. At times of crisis, it is more important than ever to take a wider perspective and consider how we might each contribute to new normative values.

*I'm interested in the people who love the world,
[and] in what they have to tell us...
Because what we do begins with
what we believe we can do.
It begins with being open to the possibilities
and interested in the complexities*

Rebecca Solnit.⁹

CONFLICT OF INTEREST

Dr Prescott reports personal fees from Swiss Biostime, Bayer Probiotic Advisory Board, Danone, Sanofi Advisory Group, outside the submitted work.

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