

VIEWS & REVIEWS

PERSONAL VIEW

The “hygiene hypothesis” for allergic disease is a misnomer

“Biome depletion” is a better term for how immune function is undermined in industrialized societies, writes **William Parker**, 25 years after *The BMJ* published David Strachan’s seminal hypothesis

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A publication by David Strachan in *The BMJ* in 1989 described the idea that a loss of species diversity from the ecosystem of the human body could lead to allergic disease.¹ Subsequent studies have focused on exactly which species of symbionts might be important,² and they have expanded the model beyond allergy to include autoimmune diseases³ and cognitive disorders related to inflammation.⁴ This view, now confirmed by a vast body of literature as a cornerstone of immunology, is likely to affect the discipline of cancer study in the future.⁵

Strachan’s view can be accurately described as “biome depletion,” an evolutionary mismatch that works in tandem with other mismatches (for example, inflammatory diets and vitamin D deficiency) to undermine immune function in industrialized societies.⁶ Strachan articulated his quantum leap of thinking in his 1989 paper, stating, “These observations do not support suggestions that viral infections, particularly of the respiratory tract, are important precipitants of the expression of atopy. They could, however, be explained if allergic diseases were prevented by infection in early childhood.”

With this statement, Strachan dismissed the prevailing notion that immune diseases, particularly asthma, were the results of infections. Instead, he suggested the seemingly bizarre notion—now widely appreciated—that colonization by an organism could prevent an allergic disease that was apparently unrelated to that organism.

Strachan’s view eventually became associated with the nickname “the hygiene hypothesis,” a term that had already been coined: David Barker used the term more than once in 1988 to explain an increasing incidence of appendicitis.^{7 8} Barker’s hygiene hypothesis used the considerably older, and now disproved, view that hygiene led to a delayed exposure to infectious agents and that it was the exposure to those infectious agents relatively late in life that caused immune disease.^{9 10}

So, Strachan’s advance was not the already long held view that hygiene was a problem; rather, he identified a loss of species diversity from the ecosystem of the human body as a problem.

With this in mind, it seems appropriate to label Strachan’s advance with a name other than “the hygiene hypothesis.” And the reasons for being careful about this label extend beyond the correct attribution of the term to its originator.

First and foremost, the term “hygiene hypothesis” has become a misnomer. Biome depletion in Western culture was indeed induced in the 20th century by the revolutionary and widespread use of such technological advances as sewer systems and water treatment facilities. However, hygiene today is associated much more with handwashing and the use of a dust mop than the availability of a toilet and clean drinking water. This modern view of hygiene—relating to personal health habits rather than advancing technology—is not a significant factor in the increased incidence of allergic disease. On the contrary, a lack of handwashing often results in an increased incidence of flu and other acute infections, many of which exacerbate rather than mitigate allergy and autoimmunity. Furthermore, modern hygienic practices often alleviate, not increase, allergy—by reducing the levels of allergens produced by organisms such as dust mites, cockroaches, and mold. Thus, allergies and autoimmune diseases are not caused by “hygiene” as people now think of it.

Issues regarding the inaccuracy of the term “hygiene hypothesis” are compounded because the biome depletion paradigm forms a fundamental principle of modern immunology and can no longer be considered a hypothesis. So, not only is the underlying cause of allergy and autoimmunity unrelated to hygiene as we understand it today, but our understanding of the cause ceased to be a hypothesis some years ago.

More important than issues of attribution or inaccuracy, use of the term “hygiene hypothesis” in connection with dreaded immune diseases gives credence to the view that hygiene is not beneficial—potentially undermining public health efforts aimed at avoiding the spread of infectious disease. Perhaps most importantly, the term diverts attention from the intuitive solution

to the problem of biome depletion: biome enrichment or restoration.¹¹

Barker's term "hygiene hypothesis," which he applied to a view much older than his own work, clearly deserves its place in the history books as part of our ongoing evolution in understanding the pandemics of noninfectious, immune related diseases that plague industrialized societies. But the term is a complete misnomer that can deflect attention from potential solutions.

It is time to provide the model with an appropriate and productive name, giving credit not only to Strachan, but also to those who have expanded the view of the model over the years to include depletion of organisms that do not necessarily cause disease, as well as a wide range of autoimmune and cognitive diseases related to immune dysfunction.

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