



The Hygiene Hypothesis Misnomer and its Potential Impact on Strategies to Tackle the Global Problem

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Allergic diseases including asthma, hay fever, eczema and food allergies have dramatically increased in industrialized countries over recent decades. Although evidence still supports the concept that immune regulation is driven by host-microbe interactions, the use of the term “hygiene”, as in “the hygiene hypothesis”, is now being seen as a misleading misnomer for this concept. Continuing use of this term means that the concept of being “too clean” persists in the minds of the public, who, as a result have lost confidence in the real meaning of hygiene. This is happening at a time when health agencies worldwide are recognizing that “hygiene must be everyone’s responsibility”, driven by issues such as the unacceptable levels of gastrointestinal diseases, the ongoing threats of infectious disease pandemics and the increasing numbers of immune-compromised people living in the community. Most importantly, hygiene is now seen as a key part of strategies to tackle the global problem of antibiotic resistance; reducing the level of infections results in fewer people seeking antibiotic treatment, thereby limiting the selective pressure for resistant strains.

Current understanding of the host-microbiome interaction and immune dysfunction is discussed in a 2016 review by a multidisciplinary group of immunologists, allergists, microbiologists and infection preventionists.¹ Evidence cited

in this review indicates that increases in inflammatory disease are the combined result of lifestyle, medical and public health changes which, particularly in early life, deprive us of exposure to microbial “Old Friends”. These “Old Friends” (OF) microbes are not pathogens (as argued by Strachan in proposing the hygiene hypothesis in 1989²), but the largely nonharmful species which inhabit the human gut and our natural environment. Although it is unclear which might be the most important, the changes which have been implicated in depriving us of exposure to OF microbes include sanitation,

clean water and food, C-section rather than vaginal childbirth, bottle rather than breast feeding, fewer siblings, urbanization and less outdoor activity. It is also recognized that communication between “Old Friends” and the

immune system is mediated by the human microbiome, and that excessive antibiotic use and altered diet can affect the microbiome in a way that further increases inflammatory disease risks. By contrast, the idea that “improved household amenities and higher standards of personal cleanliness” (as also argued by Strachan in proposing the hygiene hypothesis) are the culprit is not supported by the evidence. Studies show that the microbiome of our living environment is unique to each home, and largely reflects the inhabitants (including pets) and the surrounding outdoor environment.³ It is reasonable to

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suggest that, rather than excessive cleanliness, reduced microbial diversity in our homes reflects reduced diversity amongst family members due to fewer siblings, altered diet, antibiotic use, and less outdoor activity.

To explain the OF mechanism, Professor Graham Rook¹ likens the immune system to a computer program, which is present at birth but contains almost no data. After birth, exposure to a diversity of

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organisms is required to build memory of the diverse molecular structures present in our world. This allows not only recognition of dangerous organisms, which need to be “attacked”, but also self and harmless allergens, which need to be tolerated, because attack results in the development of inflammatory diseases.

The question then is how to connect with our microbial world, particularly during the early months of life, whilst at the same time protecting against infectious diseases. One thing is clear — we need a smarter approach to hygiene. We need to understand that hygiene is more than “keeping ourselves and our living environment clean”. It is based on understanding the key routes of infection transmission, and targeting hygiene practices in the places and at the times that matter to break the “chain of infection”, particularly times associated with food, respiratory, hand and toilet hygiene, and home-care nursing etc.⁴

Although the media now

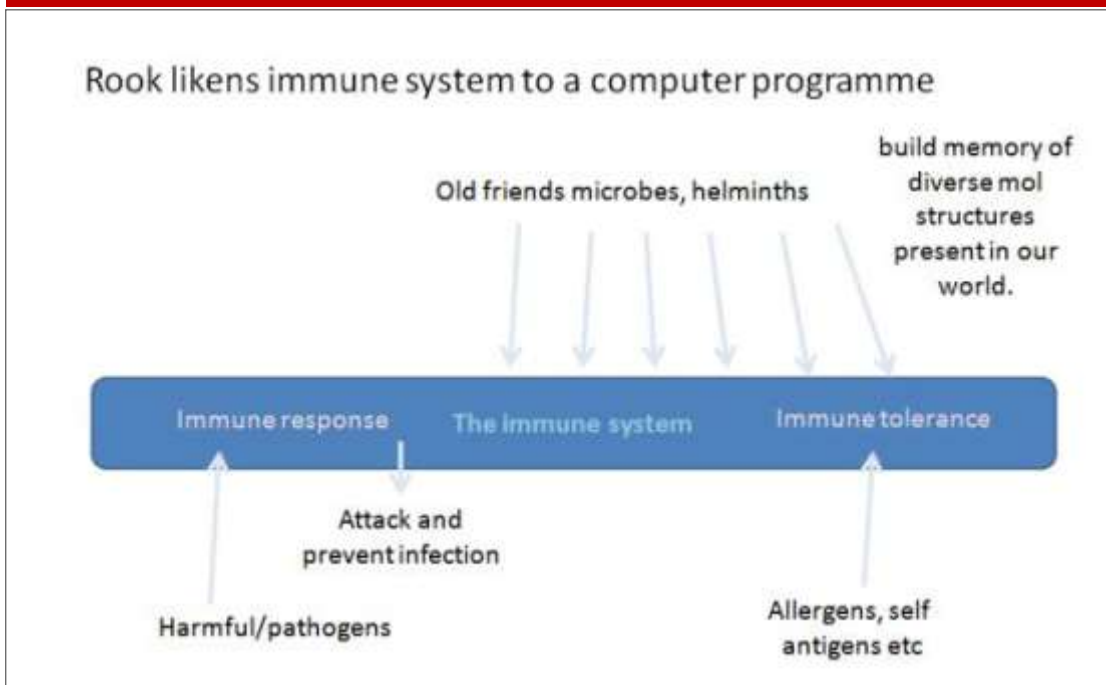
talk about the wider range of likely causes of immune dysregulation, they constantly refer to these changes collectively as “living in an over-sanitized world” and “being too clean” which continues to perpetuate the idea that

obsessive home and personal cleanliness is the key factor. Attitudes to hygiene and hygiene practice will not change until we dispel public misconceptions about the hygiene hypothesis, hygiene, cleanliness and germs. Many still tend to see

infection prevention/hygiene as “keeping ourselves and our environment clean and germ free.” But it is important to understand that people, animals and raw foods are the main sources which “harbor” germs, that hygiene is breaking the chain of infection, and that there is a difference between hygiene and cleanliness.⁵ In addition, many mistakenly believe that reconnecting with germs, i.e., infectious organisms, strengthens the immune system and reduces allergies.

There is no doubt that we are going to have to view our microbial world very differently. The idea that the human

Figure 1. Perception of the immune system as described by Professor Graham Rook¹



microbiome is essentially an organ as vital for our health as our liver and kidneys is a very different concept from the germophobic idea of living quite separately from our microbial world, which followed acceptance of the germ theory of disease in the late 19th century. But at the same time, we will need to continue to guard against infectious disease and protect antibiotic resources.

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