

The lung microbiome: a new horizon in understanding lung health and disease.

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Science pours on boons to mankind. One such great boon of recent time is the revelation that microbes are present in areas of the body been known as sterile to us. Lower respiratory tract is one such area. With our traditional system of identification of microbes, we have been carrying the notion that the airways below the vocal cords are sterile. Hence, we have been giving thanks to the mucociliary system and our immunity for the great power of keeping the lungs free of pathogens. Our traditional concept for the host-microbe interaction could have continued two dimensionally in the same fashion had it not been the genetic science and molecular biology identifying a novel probe as 16S microsomal RNA that have searched out the bacterial genome effectively and efficiently. (1) The architectural organization of the hyper-variable regions of this probe can actually identify the bacterial genera precisely (1). Other novel DNA based technologies have also proved the lower respiratory tract being unsterile and the harbouring bacterial genera that varies from normal health to disease states (2, 3, 4, 5). Thus, the revelation that our so-called sterile areas of the body are actually not sterile helps to explain a common situation in clinical practice when no bug is grown in the conventional culture media with an infection been apparent or obvious in a system. Factually, we fail to grow and identify a bug in three out of four situations in real life.

The molecular biology has revealed the fact that a human body contains and carries the micro-organisms in trillions to easily out-number the strength of cellular population in a huge way. Naturally, the new knowledge has lead to new questions. It remains intriguing to understand why the nature has kept so many of them on and inside our body and how do such virtually innumerable microbes from several genera and species with a huge genetic diversity manage to stay in harmony

amongst themselves and our active immune system. Despite their presence in such huge number, we remain healthy and that the need of antibiotics to kill bugs are really miniscule in one's lifetime if we consider our exposure to the microbial world!

Out of several kinds, the bacteroidetes and firmicutes are found to be the most prevalent phyla in the airways. They are followed by proteobacteria and actinobacteria, and fusobacteria. (2, 3, 4, 6). These bacterial microbiotas along with other similar members from the fungal and viral species forms community to exist inside the airway and the lungs. The community characteristics changes as per the relative presence of the same members and the total strength varies in different regions of the lungs. (2) They all maintain a harmony disruption of which is obvious in diseases. In addition, the commensal fungi residing with the bacterial neighbours serve interesting purpose. They are thought not only to affect the host immune system, but also to influence the bacterial community composition and restoration of the same after antibiotic treatment.(8) The orderly coexistence of different microbes in the lungs at any region and at any point of time is a matter of surprise. We can perhaps extrapolate a lot from this complex adaptive ecosystem to help the humanity society and prevent a lot of behavioural and medical hazards.

If we are plunged in a world of microbes and yet claim ourselves 'healthy', then the common sense speaks that these creatures of the micro-biological universe are a) not harming us and/or b) possibly saving us too. Whatever small knowledge the humanity has gathered could lead to an addition of an extra dimension in the understanding of diseases beyond the traditional two dimensional inter-action between a pathogenic microbe and our immunity. If the pathogenic bugs are the cause of infection, then it will be interesting to understand

the adaptive survival of a pathogenic species in the microbiota of people with no symptoms of infection. (9, 10). The third dimension may include the fact that the growth of bacterial species at a specific site in the lungs is dependent on many factors as the availability of nutrients, temperature, pH, and oxygen tension plus the inter-microbial interactions other than the intensity and characteristics of the host inflammatory response. (11) The inter-microbial interactions include inhibitory factors secreted by different microbes (12) and concomitant regulation of a specific microbial species by others through largely unknown mechanism. (8, 13) This scaffold of three or possibly more dimension of host microbe interactions has given space for more possibilities and observations to fit in.

It is found that in different diseases the community characteristics changes in quantitative and also in qualitative terms. It is thought that the normal community of microbes are essential to maintain the 'healthy status' and the change in the community characteristics may either usher a disease or can actually signify a disease state. Hence, the rational duty of mankind is to maintain the normal resident bacterial community in the lungs or any other part of the body. To do that, we may have to change a lot of our wayward thoughts and actions. We perhaps need to form strategies to live in harmony with the microbial universe in our body and accept the microbes as our friends and not as enemies. It is also interesting to learn the inter-microbial relationships and interactions. Indeed we know very little about the role of co presence of fungi and virus with bacteria; scientists believe that they carry very strong importance.

As a matter of Fact, this great lesson had been forwarded by the ancient Indians in a clear tone " Vasudaiva Kutumbakam" meaning every creature in the universe is my relation. We need to recognize and give proper importance to our relationship with the diverse microbial universe be it on or in us or be it outside our physical existence. The disharmony or 'dysbiosis' in this relationship is actually a disease state. So the future is likely to rewrite the pathogenesis of different diseases from

this point of view and a disease state or well being means a three dimensional interactions between resident microbes, the offending agents, and the host immunity

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