

## perspectives on the clean India campaign, the microbiota and ayurveda



Robert Friedland

*"...the desire of our physical system as a whole, of which we are usually unconscious...is the wish for health. This is always doing its work, mending and repairing, making new adjustments in cases of accident, and skillfully restoring the balance wherever disturbed. It has no concern with the fulfilment of our immediate bodily desires, but it goes beyond the present time. It is the principle of our physical wholeness, it links our life with its past and its future and maintains the unity of its parts. He who is wise knows it, and makes his other physical wishes harmonise with it."*

**Sadhana**, Rabindranath Tagore, 1915

In December 2014, I had the good fortune to participate in the deliberations of Chandigarh Region Innovation Knowledge Cluster(CRIKC) and visit the Department of Systems Biology in Panjab University and Neuroscience Research Laboratory at the Post Graduate Institute of Medical Education and Research in Chandigarh, India. I was I impressed by the accomplished lab workers, students and faculty and the high degree of commitment to the work at hand. On Saturday December 27<sup>th</sup> my wife Shivani Nandi, PhD and I participated in the Clean India Campaign *Swachh Bharat Abhiyan* started by Sri Narendra Modi, the Prime Minister of India. Together with Dr Akshay Anand and the members of the Neuroscience Research laboratory we ventured out around the Hospital to clean streets and alleyways. As part of the work we met many family members of patients who were living on the hospital grounds. Dr Anand and I spoke to them about the need to keep their environment clean and protect themselves and their loved ones from exposure to harmful bacteria and other agents to reduce the risk of infectious diseases. The high degree of attention with which these family members— many quite elderly- focused on our comments was truly impressive.

These interactions reminded me of our efforts in the USA to educate people about

the many environmental factors, which influence health and disease. For all of human history until now the leading cause of death has been infections from bacteria and related pathogens. Recent research has shown there is a new way in which bacteria affects our health. Research over the last 10 years has shown that our partner commensal organisms, comprised of bacteria, animal and plant viruses and other agents that reside in and on our bodies, are critical determinants of health and disease. These organisms are referred to as the *microbiota* and their cells are perhaps 10 times more numerous than our own cells. The DNA/RNA of the microbiota is called the metagenome, in contrast to the human genome, which is our own DNA. There may be as much as 130 times more nucleotide sequences in the metagenome than in our own genome. While there is a marked and dangerous bias in the USA that genes are responsible for everything, it is clear that genetic factors do not work in isolation but interact with our environment (this is particularly true in regard to our commensal bacteria).

The role of the microbiota is clearly shown by the cow, which cannot digest grass or other plant material without its gut organisms. We have evolved together with these commensal partners... they are not accidental bystanders. The microbiota have been shown to be involved in diabetes, obesity, heart disease, arthritis, inflammatory bowel disease, multiple sclerosis, cancer and many other conditions. I have recently proposed mechanisms whereby the microbiota influence protein folding and inflammation in neurodegenerative disorders Alzheimer's and Parkinson's diseases and stroke (Friedland, in press).<sup>1</sup> While gene therapy is an exciting area of research it has proven to be difficult to alter our own genome. A promising aspect of microbiota research is that the genes of our gut bacteria may be changed through diet, as the microbiota are entirely dependent on the food that we give them. Changes in diet for periods of as little as 2 weeks have been shown to have important influences on composition of the microbiota as well as resultant changes in colonic and systemic metabolism and inflammation.<sup>2</sup>

My most recent trip to the subcontinent, the Clean India Campaign and the sacred role of the cow in Hinduism and other religions found me dwelling on the several thousand-year history of medicine in India and around the world. Ayurveda, originating in the Vedic culture of India, is the product of traditions going back perhaps 5,000 years. Ayurvedic teaching promotes preventive holistic medicine. Intestinal functioning is an important concept in Ayurveda and influences of intestinal function on many disorders of the nervous system are recognized. Remedies promoted by Ayurveda include those designed to regulate intestinal function, including what we now call probiotics (provision of desirable bacteria for intestinal colonization, such as fermented products, curds and yoghurt) and prebiotics (provision of food for desirable bacteria, such as indigestible fiber in resistant starch and complex polysaccharides). One such fiber used in Ayurveda is psyllium husk [sat-isabgol, *Plantago ovata*]. Probiotics have become widely recommend for several indications and fermented products containing bacteria are now believed to be health promoting. (There are nearly 12,000 references to "probiotics" in the US National Library of Medicine database 1/29/2015). It has been reported that consumption of dietary fiber enhances production of short-chain fatty acids (SCFAs) butyrate, propionate and acetate by intestinal bacteria. The SCFAs provide energy for colonocytes and promotes the development of anti-inflammatory regulatory lymphocytes (Treg cells expressing the transcription factor Foxp3).<sup>3-4</sup> The ability of dietary fiber to suppress systemic inflammation and oxidative stress has been reported in inflammatory bowel diseases, colon cancer, chronic kidney disease, nonalcoholic fatty liver disease, and peripheral artery disease. The influences of diet on health and disease have been known to Ayurvedic practitioners for millennia. The mechanism of these is now known to operate, at least in part though influences on the microbiota.<sup>2</sup>

There are also myriad plant products recommended in Ayurveda which contain polyphenols, flavonoids, omega 3 poly-

unsaturated fatty acids, antioxidants and other compounds which have recently become indicated for the preservation of health.<sup>5-6</sup> Curcumin, a yellow polyphenolic pigment made from the roots of *Curcuma longa* (Family: Zingiberaceae), is a component of turmeric and is being widely studied for its anti-cancer, anti-inflammatory, anti-oxidant and anti-amyloid effects.

The opportunity to gain therapeutic avenues through study of traditional medicines has been known for some time. Recent work on the microbiota offers us a way to better understand the mechanisms of these effects. In this context, the establishment of a separate Ministry of Ayush (Ayurveda, Yoga, Unani, Siddha and Homeopathy) to revive traditional medicine by Indian PM is commendable. I look forward to the opportunity to work with physicians, scientists and industry in India and elsewhere to learn from the

thousands of years of Ayurvedic tradition. There are many reasons to be hopeful that this approach will be of value in developing a needed understanding of disease origin and progression as well as new ways to maintain health. This has the potential to become another extremely successful "Make in India" story.

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