Another interesting feature affecting various functional foods is fermentation, as in the case of several Asian cuisines. For instance, fermentation may significantly modify the original active ingredient. In the case of Fermented Papaya Preparation (FPP) the ratio between complex carbohydrates and proteins increases significantly on fermentation. While papaya *per se* has significant antioxidant capacity, FPP exerts an epigenetic effect to beneficially balance the whole redox environment.[30] Similar observations open the way to applications using nanotechnology aimed at cellular targeting of functional food and bioactive compounds over the classical dose approach.

Nobel laureate Elie Metchnikoff recognized and suggested the concept of probiotics in the early 1900s while studying gut flora, and later, the term "probiotics" was coined by Lilly and Stillwell in 1965.[31] Probiotics are viable microorganisms that have a symbiotic relation with the host and play a role in modulating the mucosal and systemic immunity of the host within a wider metagenome playground. In recent years, based on Metchnikoff's perspective, the important role of microbial milieu in the oral cavity has been pointed out as a potential source of triggering factor in systemic illnesses.[32] Thus, this represents an amenable opportunity to rational interventions, but nanotechnology might be required for solving nutrient delivery strategies. Probiotics are chosen as novel potential weapons in global health strategies when considering the solid experimental and preliminary clinical literature pointing out the role of gut microbiota in virtually all chronic illnesses, from metabolic to neurodegenerative diseases, and probiotic interventions have been proved to have a pro-longevity effect on an experimental basis.[33–36] Various strains of lactic acid bacteria like lactobacilli, bifidobacteria and streptococci are considered as probiotic and the use of prebiotics like inulin, oligofructose, and galactooligosaccharides along with probiotics have been reported to support the growth of probiotics in the gut by promoting their function and/or viability *via* fermentation.[37,38] Heidarpour and coworkers reviewed the available nanocarrier systems utilizing prebiotics developed for oral delivery of bioactive compounds including vaccines, vitamin, hormones, nutraceuticals, minerals and food supplements. According to the authors, oral delivery has the best patient compliance, and prebiotic-based bioactive delivery systems can be used not only for humans, but also in veterinary therapeutic applications.[39] Microencapsulated probiotics have received a great deal of attention and have provided evidence of their higher efficacy on allergic and metabolic disease treatment, and for antimutagenic properties.[40–44] The opportunities of evolving nanotechnology related applications using probiotics hold great promise when considering the potential of probiotics that go well beyond basic gut function, nutrients and vitamin handling; probiotics are important in modulating endocrine systems, behavior and neuromodulation from birth to adult chronic and acute brain disease.[45–52] Recently, microbiome study has come up with "New Directions in Cardiovascular Disease Research, Prevention, and Treatment", as stated by the American Heart Association.[49] This is another area of paramount importance where nanotechnologies applied to bioactive compounds and specific probiotics may open up new and promising avenues to pursue.