Intestinal bacteria and anti-cancer therapy

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All higher organisms are thought to have evolved together with commensal microorganisms. Those microbes include bacteria, virus, fungi and archaea and they affect the physiological homeostasis of the host and disease pathogenesis by constantly interacting with host cells. Humans are estimated to harbor up to 100 trillion bacteria, which are more than the total number of cells that comprise the human body. Those commensal bacteria are most enriched in the intestine and regulate food digestion, vitamin synthesis, metabolism, immune response, and even brain function. The recent studies have especially improved our understanding on the interaction between intestinal bacteria and host immune cells and its underlying molecular mechanisms. Now it became clear that variations in the intestinal bacteria composition amongst people highly influence an individual's susceptibility to pathogen, response to vaccine immunization, and development of autoimmune disease, chronic inflammatory disease and cancer.

In case of cancer, certain intestinal bacteria express oncogenes and directly promote tumorigenesis. On the other hand, many other intestinal bacteria species have been shown to boost anti-cancer immune response and improve the overall survival in animal models. In cancer patients, intestinal bacteria composition serves as a key factor for deciding patients' response to cancer treatment such as chemotherapy, radiotherapy, and immunotherapy. Notably, transplantation of fecal material collected from cancer survivors, who showed a dramatically positive response to immune checkpoint inhibitors such as anti-PD-1 or anti-PD-L1 antibodies, has been shown to convert non-responders who previously failed such immunotherapies into responders. Based on these findings, many academic laboratories and pharmaceutical companies are currently trying to develop a single or a mixture of specific intestinal bacteria species as an adjuvant for anti-cancer therapy.