[Gut Bacteria Rivals Immunotherapies in Cancer Treatment](http://blog.fisherbioservices.com/gut-bacteria-rivals-immunotherapies-in-cancer-treatment)

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The human gut contains more than 100 trillion bacteria from perhaps 500 or more different species. In fact, gut bacteria outnumber the cells in the human body. The vast number of these bacteria has caused researchers to take a closer look at how they are related to health and disease. Now, breaking scientific research suggests that gut bacteria may be more important than anyone previously realized: they appear to be effective cancer treatments.



**Evaluating the Research Using Gut Bacteria for Cancer Treatment**

Several recent studies have focused on the role of gut bacteria in cancer treatment. In a [recent Science paper](http://www.ncbi.nlm.nih.gov/pubmed/26541606), researchers from the University of Chicago compared [immunotherapy](http://blog.fisherbioservices.com/breakthroughs-setbacks-in-cancer-immunotherapies) to administration of gut bacteria in the treatment of skin cancer in mice. They noticed that spontaneous antitumor immunity was different between mice with distinct intestinal microbiota. After cohousing or performing fecal transfer to ensure the[microbiota](http://blog.fisherbioservices.com/curing-crohns-disease-how-data-and-the-gut-microbiota-proteome-are-working-together) were now the same, the mice showed no differences in antitumor immunity.

To follow up on these observations, the researchers performed a comparison between immunotherapy and use of gut bacteria in cancer treatment. The immunotherapy treatment was a checkpoint blockade targeting programmed cell death protein 1 ligand 1 (PD-L1), which triggers T cell attack of tumor cells. Prior research has demonstrated the success of checkpoint blockades, and this approach is used to treat certain forms of human cancers. The gut bacteria condition involved oral administration of Bifidobacterium, a common gut bacterium. The results indicated that Bifidobacterium was equally effective as immunotherapy in suppressing tumor growth. When combined, these two treatments nearly abolished tumor growth entirely.

Another [recent study published in Science](http://www.ncbi.nlm.nih.gov/pubmed/26541610) assessed how gut flora could modulate response to immunotherapy. They found that treating mice with antibiotics, which eliminates beneficial bacteria in the gut biome, resulted in a lack of response to CTLA-4 cancer immunotherapy. Colonizing the gut with Bacteroides fragilis overcame this defect and stimulated a robust anti-tumor response. Thus, the bacteria in the gut may affect how some patients respond to cancer treatments.

Indeed, the health of the gut biome may have reverberating effects that last for generations. A [2015 paper published in Cancer Research](http://cancerres.aacrjournals.org/content/75/7/1197.short) used animal models to investigate the effects of intestinal biome on risk for disease. The Massachusetts Institute of Technology researchers discovered that exposure of grandmother mice to a Westernized diet (high fat, low fiber) led to differences in their intestinal microbiata that increased risk of obesity, liver cancer, and lung cancer in the subsequent two generations. Subsequent administration of beneficial microbes decreased transgenerational cancer risk, suggesting that these effects can be modified by an individual’s current dietary choices.

**Implications for Human Cancer Research**

Collectively, these findings indicate that there is more to the gut than meets the eye. Maintaining a [healthy intestinal microbiome](http://blog.fisherbioservices.com/the-microbiome-of-the-skin-and-beyond-the-mobe) may be effective in decreasing cancer risk and could actually improve response to immunotherapy cancer treatment. To date, however, studies have primarily been performed in rodents. [Human research](https://jnci.oxfordjournals.org/content/early/2013/11/27/jnci.djt300.full) suggests that patients with colorectal cancer have a less diverse gut biome than control subjects, but no human trials have been reported to explore colonization of beneficial gut bacteria as a potential cancer treatment.

One large remaining challenge includes how to best develop pharmaceutical interventions that capitalize on the beneficial effects of gut bacteria. One avenue for transmission of healthy intestinal microbiota is fecal transplant. Although this procedure has been used for treatment of C. difficile colitis, it exposes patients to the risk of transferring parasites, pathogens, or blood-borne illness from the fecal donor. For immunocompromised cancer patients, these side effects could be catastrophic.

Early efforts have focused on the development of probiotic foods and supplements that facilitate the growth of beneficial bacteria. However, other dietary factors can affect a patient’s ability to maintain a healthy gut biome. Future research must explore the resilience of the microbiome to change as well as methods to alter the intestinal microbiome in a way that is beneficial and long-lasting.

To have the most robust anti-cancer effects, additional research is needed to determine the mechanisms by which beneficial bacteria modulate response to immunotherapy treatments. Some bacteria may have a positive response on immune system activity, while others could potentially turn off the immune response. Additionally, there may be individual differences in the effects of certain bacteria on antitumor activities -- what works for one patient may be detrimental to another. Given the complexity of the human microbiome, considerable biotech research is needed for pharmaceutical companies to create effective cancer treatments in this area.

The most effective approach to addressing cancer is prevention, and if treatment is necessary, it is best at an early stage, which is associated with much higher survival rates as well as lesser side effects. To learn more about innovative, well-validated screening test for cancer detection, download our eBook Smart Biobanking: From Samples to Predictive Algorithms for Detecting Cancer.