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### **Curing Mental Health Disorders One Microbial at a Time**

Karyss Thompson

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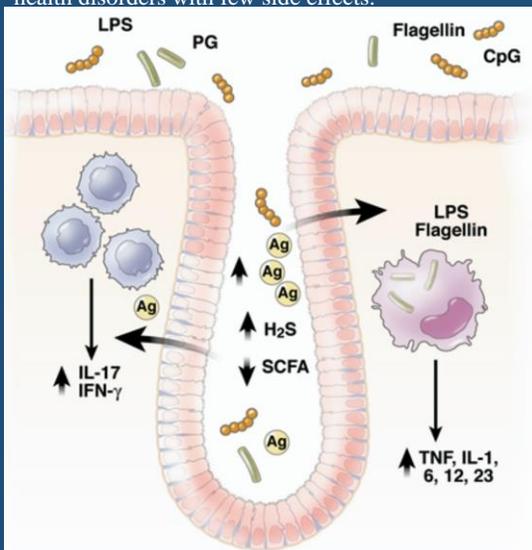
# Curing Mental Health Disorders One Microbial at a Time

By Karyss Thompson

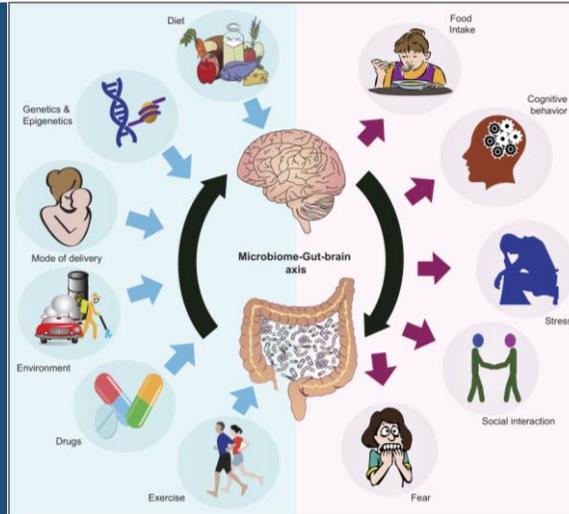
Chapman University Biochemistry Program

## Abstract

The connection between one's mental health and gut microbiome has been a topic of recent research and has led to the emergence of a new field of study, "psychobiotics". The gut contains approximately  $10^{13}$ - $10^{14}$  microbial cells and viruses that have an important role in the healthy metabolic function of their host. When this symbiotic relationship between bacteria and host is off balance, it can lead to several medical conditions such as inflammatory bowel disease. Studies of the modern microbiome have suggested there is a link between some mental health disorders like anxiety and depression and an unhealthy gut. One indication of this connection is the prevalence of major depressive disorder among individuals with gastrointestinal illnesses, which are often caused by bacteria that are part of our normal microflora. Additionally, some studies have found increased levels of immune response, such as inflammation, in individuals with depression and other mental health related issues. This increase in immune response is believed to be caused by gut dysbiosis, an imbalance in the microbiome. Therefore, an imbalance in the gut microbiome could result in an increase in mental health related issues for an individual by inducing an immune response. While further research is required, this new field of study could eventually provide successful treatments for mental health disorders with few side effects.



**Figure 1:** A decrease in bacteria that produce SCFA such as butyrate enhances gut permeability. An increase in bacteria that produce toxic metabolites such as  $H_2S$  can also increase gut permeability and block butyrate metabolism (Image from R. Balfour Sartor, 2008).



**Figure 2:** Illustration of the factors that influence the Microbiome-Gut-Brain axis (left side of image) and the factors that are influenced by this axis (right side of image) (Image from Cryan et. al., 2019).

## Summary of Research Findings

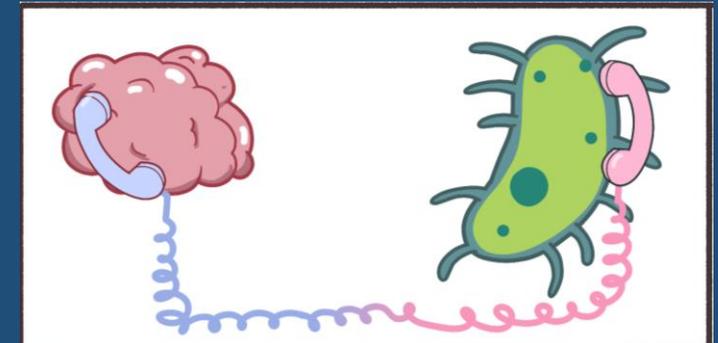
- Depressive symptoms improved with the use of probiotics.
- The microbiome composition of individuals with MDD had significant differences when compared to those of healthy individuals
  - Actinobacteria and Firmicutes, and Bifidobacterium and Blautia were found to be more abundant in MDD patients.
  - Bacteroidetes and Proteobacteria, which are gram-negative, were found to be higher in abundance in healthy control individuals
  - Depressed individuals showed depleted levels of Dialister
- Individuals on a strict diet (gluten free or vegetarian), in general, had higher levels of PTSD, anxiety and depression symptoms
- Fecal microbiome transplant treatment improved depression symptoms.
- The abundance of lactobacillus spp. was associated with more positive self-judgement and decreased levels of depression.
  - The reverse was also true
- Individuals who experience more psychological distress also experience higher levels of inflammatory responses
- Increased bacterial translocation causes increased immune responses and is associated with increased depressive symptoms.

## Conclusions

The connection between the microbiome and mental health is bacterial translocation. A change to the microbiome causes increased gut permeability and bacterial translocation which induces inflammation resulting in increased depressive symptoms. An example of this is illustrated in Figure 1 to the left.

## Future Research Ideas

- What are all the changes to the microbiome that can cause the gut to be more permeable and lead to bacterial translocation.
- A comprehensive study simultaneously studying multiple different probiotics and prebiotics.
- Determine the best treatment option (which probiotics and prebiotics are most effective)



**Figure 3:** Image from Rhy-Jones, 2020