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Differences in Gut Bacteria Composition May Contribute to Some Cases of Autism Spectrum Disorder

What is this research about?

Our intestines contain a vast and diverse community of bacteria that help us absorb nutrients and develop the immune system. Stress, through its influence on the brain, can have a drastic effect on these bacteria, causing cramps, upset stomach, as well as a 'leaky' gut, which leads to certain contents of the intestines spilling into the bloodstream. However, this is a two-way relationship: the bacteria in our gut can influence the brain as well. This research looked at the biological processes beneath the behaviour and gastrointestinal (GI) abnormalities that are often observed together in autism spectrum disorder (ASD).

What did the researchers do?

The researchers utilized a common mouse model of ASD—Maternal Immune Activation (MIA)—in which pregnant female mice are injected with a mock virus. Offspring of these females display the common behavioural symptoms of ASD, including anxiety, obsessive and repetitive behaviour, and poor social behaviour. The researchers first analyzed the different bacteria types in the gut and looked for the presence of a leaky gut, which is often observed in individuals with ASD. To understand how changes in the bacteria types might affect the brain, the researchers then examined the levels of substances produced by bacteria and their effect on behaviour. In the second part of the study, a commonly used probiotic—live bacteria with beneficial effects,

What you need to know:

The trillions of bacteria in the gut play an important role in the development and function of the brain. Using a mouse model, this study highlights their involvement in brain development and contribution to symptoms of autism spectrum disorder (ASD). The use of probiotics in this model alleviated behavioural symptoms and GI abnormalities, and may be a therapeutic approach in the treatment of ASD symptoms.

B. fragilis, was added to the food to investigate its effects on the autistic-like symptoms of these offspring mice and their gut bacteria types.

What did the researchers find?

Offspring from the MIA mouse model had different bacteria types and several GI changes resembling those observed in patients with ASD, including a leaky gut. The researchers also found strikingly high bloodstream levels of 4EPS molecule in the mice, similar to one produced in high levels in clinical cases of ASD. When 4EPS was injected into healthy mice, they became anxious and behaved more similarly to MIA offspring.

MIA offspring that were fed the probiotic restored the gut bacteria population to that of normal, healthy mice. It also improved the GI abnormalities and drastically reduced the levels of 4EPS in the bloodstream. Most remarkably, the researchers discovered that the probiotic improved some



autistic-like behaviours. These included reduced anxiety, improved vocal communication, and reduced obsessive and repetitive behaviour. However, the mice continued to display poor social interaction, suggesting that this particular probiotic does not resolve all the symptoms related to ASD.

How can you use this research?

Discovering the role of the gut highlights the complex nature of ASD. While this study is promising and paves the way in outlining innovative approaches to therapy for patients with ASD, these findings are still novel and warrant further rigorous research. Thus, caution should be advised against the use of popular nutritional supplements and over-the-counter substances in the treatment of ASD without first consulting a physician.

About the Researchers

Elaine Y. Hsiao, the lead author, is currently an Assistant Professor at the University of California, Los Angeles. E.Y.H., S.W.B., S.H., G.S., J.A.C., J.C., S.E.R., P.H.P., & S.K.M. are affiliated with the California Institute of Technology. E.R.H., T.M., & J.F.P. are affiliated with the Baylor College of Medicine.

Citation

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Keywords

Gut bacteria, autism spectrum disorder, behaviour, maternal immune activation, probiotics, mouse model

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About the Chair

The Chair in Autism Spectrum Disorders Treatment and Care Research is dedicated to studying ways to improve the mental health and well-being of people with Autism Spectrum Disorders (ASD) and their families in Canada.

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