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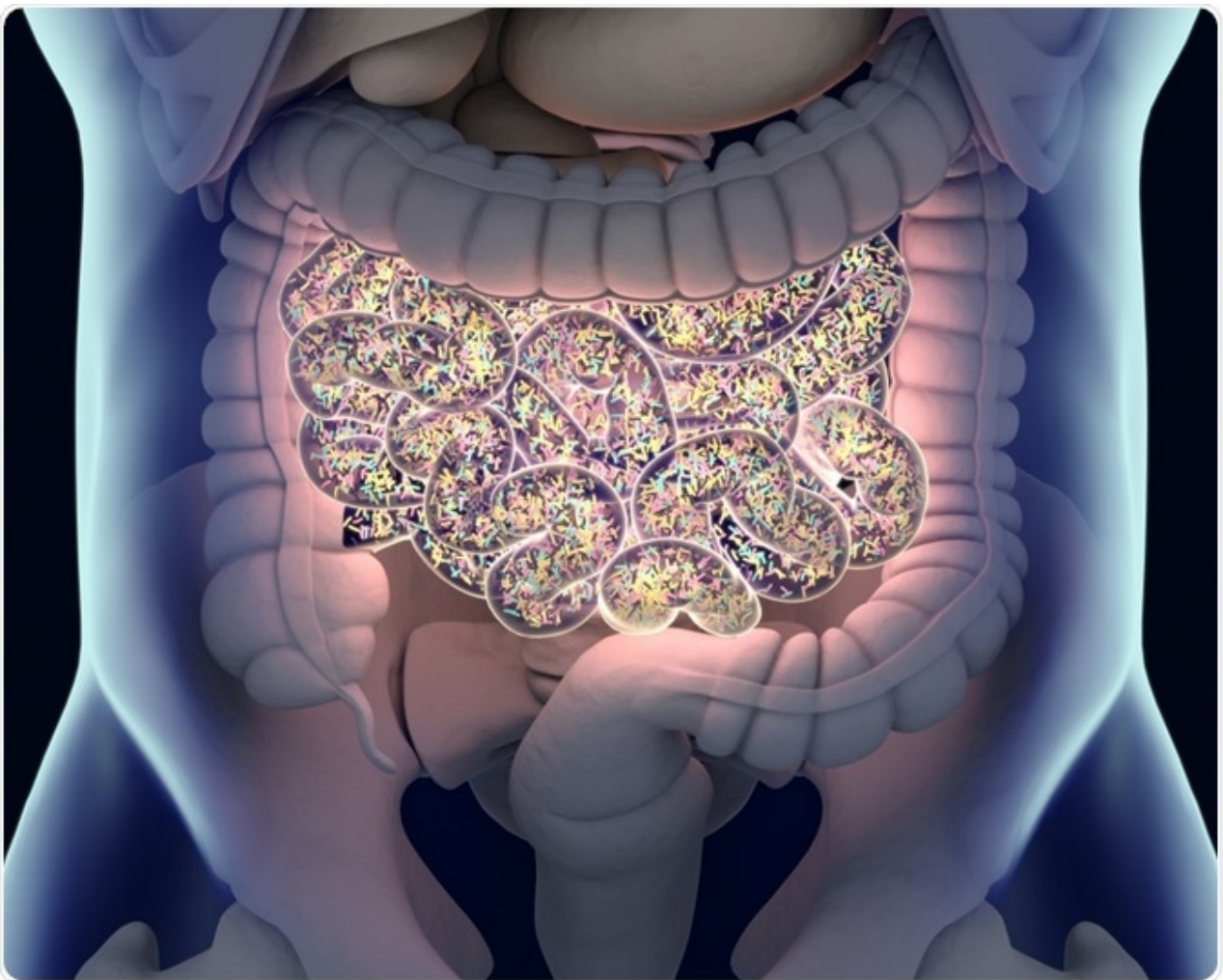
Gut-Brain Axis and Neuropsychological Disorders



By Tomislav Meštrović, MD, PhD

Reviewed by Liji Thomas, MD

Studies have shown that multiple neuropsychiatric disorders can be linked to modulations in the gut microbiome.



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The gastrointestinal system is considered our largest immune organ, but some of its products may be pathogenic to the central nervous system. This is explained by the existence of a gut-brain axis, which is a complex two-way communication network between the gastrointestinal system, its resident microbiota and the brain, that has a role in modulating gastrointestinal, immune and nerve functions.

Potential mechanisms that can influence the central nervous system include changes in the content of gut microbiota, neural pathways (most notably via the vagus nerve), immune stimulation, gut hormonal response, as well as secondary bacterial metabolites.

Recent studies have shown that various neuropsychiatric disorders (such as autism spectrum disorder, anxiety, depression, and schizophrenia) can be linked to modulations in the gut microbiome, and also to the influence of certain microbial substrates, or the use of antibiotics, probiotics or prebiotics.

Autism spectrum disorder

Some research has shown that children with autism have high abundance of *Bacteroidetes* and *Proteobacteria*, but lower numbers of *Bifidobacteria* and *Firmicutes* when compared to healthy children. However, one class of bacteria from the *Firmicutes* is present in higher numbers in children who have autism and a history of gastrointestinal problems – those are members of the *Clostridium* genus.

On the other hand, there is a low number of *Prevotella* species, despite the overall abundance of *Bacteroidetes* in children with autism. This means that mere quantification of the relative increase or decrease in the phyla populations is not as significant as determining the counts of specific intestinal symbionts, in order to better comprehend the importance of specific changes in the gut microbiome and the brain functioning.

The counts of bacteria from the genus *Sutterella* and *Ruminococcus* were also elevated in gastrointestinal biopsies that were taken from children with autism. All these discoveries support a potential gut-brain connection in autism spectrum disorder and support a quest for a possible probiotic treatment.

Anxiety and depression

The relationship between the gut microbiota and the development of anxiety and/or depression has been researched mainly in animal models. In rats, the oral administration of *Campylobacter jejuni* in subclinical doses resulted in anxiety-like behavior without a resulting immune response.

Moreover, the introduction of microbes from the *Bacteroides* family have been associated with depression. Certain author groups have reported that a low-level, chronic inflammatory condition is associated with depression, which may be linked to certain gut permeability disorders. Moreover, the gut microbiota has been recognized as a key factor when unhealthy diets are studied in association with depression.

Schizophrenia

Premature delivery has been shown to increase the risk of development of schizophrenia. Furthermore, infants born via Cesarean section show lower levels of *Bacteroidetes* and *Bifidobacteria*, and increased colonization with *Clostridium difficile* when compared to infants born vaginally. There is now ample evidence of benefits for the developing brain from the presence of *Bifidobacteria*; conversely, *Clostridium difficile* is an undesirable, aberrant pathogen.

There are cases of schizophrenia linked to *Clostridium difficile* infection. An association has been observed with the modulation effects exerted by the phenylalanine derivative that is produced by this bacterial species. However, thus far there are no prospective research studies that evaluate the outcome of (otherwise) healthy babies colonized with this organism.

Although the current results are not sufficient to draw steady conclusions about the clinical potential of the microbiota-based therapy strategies in neuropsychological disorders, it is undoubtedly an exhilarating frontier in psychology and psychiatry research.

Sources

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Further Reading

- [Gut-Brain Axis and Neurodegenerative Disorders](#)
- [Gut-Brain Axis and Obesity](#)
- [Gut-Brain Axis and Psychobiotics](#)
- [What is the Gut-Brain Axis?](#)

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