

Research that potentially links autism and brain-gut microbiome

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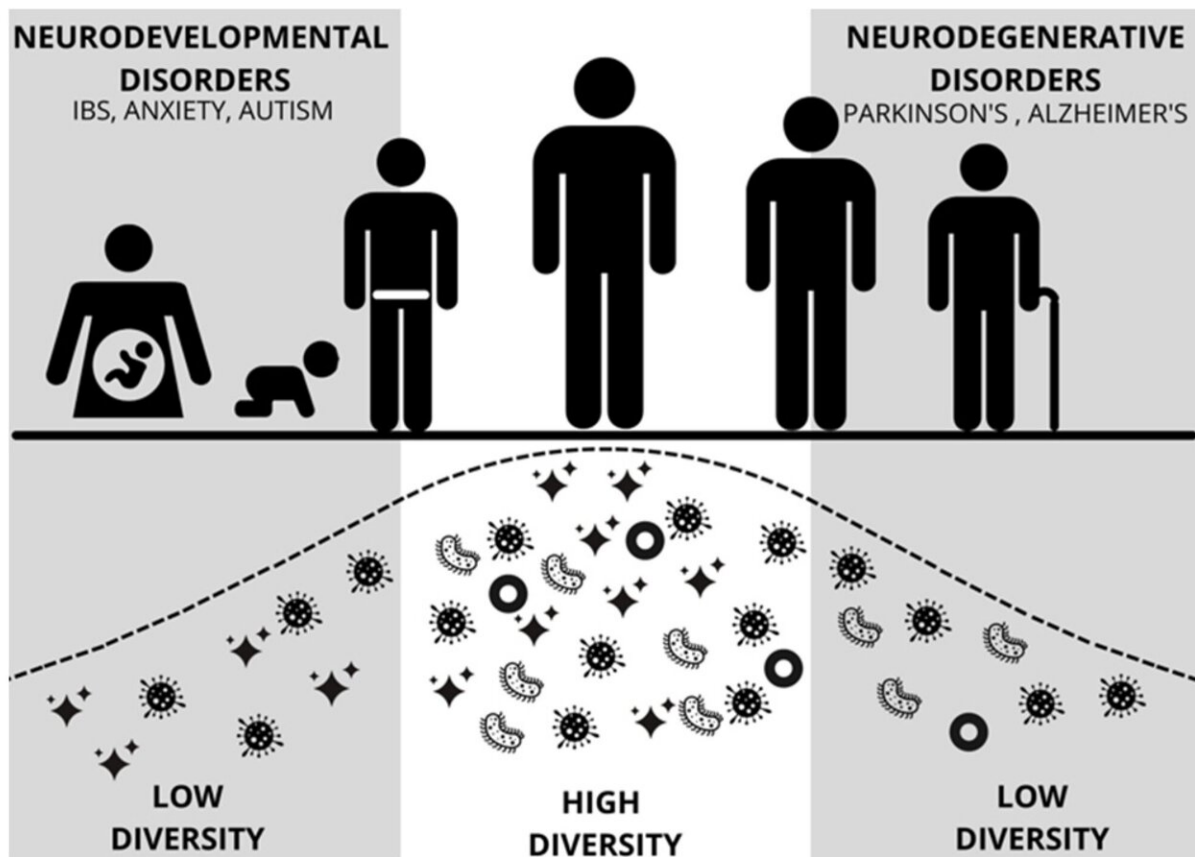


Figure modified from Mayer [9] depicting diversity and abundance of gut microbes across the lifespan of a human. Early and late periods of low diversity coincide with vulnerability to neurodevelopmental disorders and neurodegenerative disorders, respectively. IBS = Irritable Bowel Syndrome. Credit: DOI: 10.3390/nu13124497

A new scoping review of nearly 200 publications covering the relationships between autism spectrum disorder and the brain–gut–microbiome system was published online today in *Nutrients*. The review synthesizes the growing body of research suggesting that gut microbiota—the trillions of microorganisms living within the human digestive system—may serve critical roles in modulating brain functions, social behaviors and autistic symptoms.

Two of the review's co-first authors, Michelle Chernikova and Genesis Flores, were participants in USC's Diversity, Inclusion, and Access JumpStart program, a structured summer research program for talented undergraduates considering pursuing a Ph.D. degree, at the time of literature review and manuscript preparation.

Joining as co-first author is Emily Kilroy Ph.D. '18, Postdoc '22, a postdoctoral scholar in the USC Chan Division of Occupational Science and Occupational Therapy. Jennifer Labus and Emeran Mayer, microbiologists at the University of California, Los Angeles, are co-authors. Senior author is Lisa Aziz-Zadeh, associate professor at the USC Chan Division jointly appointed to the USC Dornsife College of Letters, Arts and Sciences' Brain and Creativity Institute.

The review synthesizes current understandings about the mechanisms by which gut microbiota, metabolic substances and the brain communicate to influence behaviors, including the different social–communication and restricted or repetitive patterns that characterize autism.

Gastrointestinal symptoms such as abdominal pain, constipation and diarrhea have been reported in 46 to 84 percent of autistic people, giving recent rise to a hypothesis that gut dysregulation may be especially prevalent in autistic populations.

The paper was supported in part by Aziz-Zadeh's four-year, \$506,000 grant from the U.S. Department of Defense's (DoD) Autism Research

Program Idea Development Award.

"To date, most autism studies in humans either look at the brain and behavior, or at the gut microbiome and behavior," Aziz-Zadeh said. "Our DoD study is one of the largest autism studies to look at all three factors together—brain, gut and behavior. The current paper in *Nutrients* lays down the theory behind this endeavor, reviewing everything from rodent studies on the topic, potential neurotransmitter pathways that may be involved and potential brain regions that may be modified by this interaction."

Scientists have yet to determine the exact microbial composition associated with autism, and the authors recommend several future research directions. Those include the need for more standardized sampling, collection and analyses; research studying the prenatal gut microbiome in pregnant mothers; studies comparing the microbiomes of autistic and typically-developing populations; and longitudinal tracking of metabolic states and specific biomarkers through early childhood development.

More information: Michelle A. Chernikova et al, The Brain-Gut-Microbiome System: Pathways and Implications for Autism Spectrum Disorder, *Nutrients* (2021). [DOI: 10.3390/nu13124497](https://doi.org/10.3390/nu13124497)

Provided by University of Southern California

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