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Scientists identify metabolic features specific to the autistic brain

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Skoltech scientists looked into the differences in the concentrations of multiple metabolites in healthy humans and individuals suffering from Autism Spectrum Disorder (ASD), gaining a deeper insight into the

molecular processes that take place in the brain of autistic individuals. The results of the study were published in Nature's *Communications Biology* journal.

ASD is a range of nervous system disorders that manifest themselves primarily through impairment of cognitive functions and social communication and interaction abilities. The underlying molecular mechanisms of ASD are still poorly understood.

Scientists from the Skoltech Center for Neurobiology and Brain Restoration (CNBR), the Icahn School of Medicine at Mount Sinai (ISMMS, New York, USA), the Max Planck Institute in Potsdam, and the Cologne Institute (Germany) studied metabolites, tiny molecules that form in the prefrontal cortex as a result of biochemical reactions in the human system, both in healthy people and individuals with ASD, and compared the results to the tests made for the same brain region in macaques and chimpanzees. The study was performed using mass spectrometry, a highly accurate and sensitive analytical technique, that helped register and measure the concentrations of 1,366 different molecules clustered in 16 metabolic pathways.

Using blood and urine samples from healthy people as a reference, the scientists discovered multiple differences in metabolite concentrations between autistic and healthy humans. Interestingly, most of those differences are known to be related to the metabolic pathways that were found earlier in the urine and blood samples taken from autistic individuals. When comparing the brain metabolites in humans and other mammals, including chimpanzees and macaques, it becomes clear that a marked difference between healthy and autistic individuals is observed in those metabolic pathways which are affected by multiple human-specific evolutionary changes, which leads the scientists to believe that autism tends to disrupt evolutionarily novel mechanisms.

"Some earlier studies clearly pointed to the differences in metabolite concentrations in urine and blood, but fell short of establishing a possible connection to the brain processes. Our team focused on the prefrontal cortex, where we identified a host of ASD-specific metabolic features. We compared metabolites in the human brain to those in the brains of chimpanzees and macaques and found that ASD affects evolutionarily novel metabolic pathways," says one of the authors of the study and Assistant Professor at Skoltech, Ekaterina Khrameeva.

More information: Ilia Kurochkin et al, Metabolome signature of autism in the human prefrontal cortex, *Communications Biology* (2019). DOI: 10.1038/s42003-019-0485-4

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