

# Normal gut microbiota modulates brain development and behavior

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## Abstract

Microbial colonization of mammals is an evolution-driven process that modulate host physiology, many of which are associated with immunity and nutrient intake. Here, we report that colonization by gut microbiota impacts mammalian brain development and subsequent adult behavior. Using measures of motor activity and anxiety-like behavior, we demonstrate that germ free (GF) mice display increased motor activity and reduced anxiety, compared with specific pathogen free (SPF) mice with a normal gut microbiota. This behavioral phenotype is associated with altered expression of genes known to be involved in second messenger pathways and synaptic long-term potentiation in brain regions implicated in motor control and anxiety-like behavior. GF mice exposed to gut microbiota early in life display similar characteristics as SPF mice, including reduced expression of PSD-95 and synaptophysin in the striatum. Hence, our results suggest that the microbial colonization process initiates signaling mechanisms that affect neuronal circuits involved in motor control and anxiety behavior.