Gut, microbiota and the brain

Novel insights into microbiota-gut-brain signalling in reward and obesity
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The gastrointestinal microbiota is emerging as a unique and inexhaustible source for metabolites with potential to modulate G-protein coupled receptors (GPCRs). The ghrelin receptor [growth hormone secretagogue receptor (GHSR)-1a] is a GPCR expressed throughout both the gut and the brain and plays a crucial role in maintaining energy balance, metabolism, and the central modulation of food intake, motivation, reward, and mood. Short-chain fatty acids (SCFAs), lactate, and different bacterial strains, including *Bifidobacterium* and *Lactobacillus* genera, can modulate GHSR-1a signaling. We identify, for what is to our knowledge the first time, a potent effect of microbiota-derived metabolites on GHSR-1a signaling with potential significant consequences for host metabolism and physiology.

Shaping a second brain in the bowel: a microbial perspective in the context of malnutrition
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Undernutrition-induced stunting is a major worldwide health issue, affecting 150 million children under 5 years of age[1]. In early life, it is associated with persistent stunting. We previously demonstrated the ability of selected probiotic strains to buffer the deleterious effect of undernutrition on juvenile growth[2]. Besides deficiencies in the central nervous system, malnourished animals also show abnormal development of the ENS. In order to selectively address how the microbial environment shapes maturation of the ENS after weaning, we used a mouse with a simplified microbiota. Overall, our findings suggest that modulating the microbial environment during malnutrition shapes the maturation of the ENS. Further studies will reveal the mechanisms underlying such phenotypes.

[1] 2020 Global Nutrition Report. https://globalnutritionreport.org/.
[2] Schwarzer, M. et al. Lactobacillus plantarum strain maintains growth of infant mice during chronic undernutrition. Science **351**, 854–857 (2016).

Microbiota-gut-brain axis, stress and behavior
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In recent decades, the concept of the gut microbiota as a potential novel therapeutic strategy for mental health has emerged. The tiny microbes inhabiting our gut communicate through a bidirectional communication signaling with the brain that influences gut physiology, brain function and behavior. Growing evidence indicates that the gut microbiota can influence stress-related behaviors, including those relevant to anxiety, depression, and cognitive impairment. Such findings encourage the discovery of microbiota-targeted treatments as novel potential pharmacological strategies against psychiatric illnesses.

Targeting the microbiota-gut-brain axis in Alzheimer's disease
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A rapid population ageing has resulted in a growing number of patients with Alzheimer's disease (AD) that creates an increasing need for early diagnosis, treatment and prevention of illness. Additionally, the growing "epidemic" of diabetes and its close relationship with AD is increasingly becoming more evident that led researches to investigate how these diseases have an influence on each other. In both cases, impaired immune system that is closely related to the gut microbiota has been reported. With the growing number of facts about the effects of the microbiota on various physiological processes in the body, its exploration has been chosen not only to better understand the mechanism of AD progression, but also to use it as a biomarker in order to create a method for early diagnosis of the disease, which would enable doctors to start treatment much earlier.