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## **IS THERE A ROLE FOR GUT BACTERIA IN GUT-BRAIN AXIS HOMEOSTASIS?**

**Pio Maria Furneri<sup>a</sup>**

<sup>a</sup> Microbiology and Clinical Microbiology – University of Catania (BIOMETEC), Catania, Italy

Corresponding author: [pio.furneri@unict.it](mailto:pio.furneri@unict.it)

### **ABSTRACT**

The gut–brain axis has become one of the most compelling models through which to reinterpret the relationship between microbial ecology, host physiology and systemic homeostasis. Far from being a passive microbial reservoir, the intestine represents a complex biological interface where bacteria, epithelial barriers, immune mediators, endocrine signals, neural pathways and environmental stimuli continuously interact. In this perspective, gut bacteria are not merely inhabitants of an intestinal habitat, but active regulators of the dialogue between the internal milieu and the central nervous system. This lecture will explore the role of lactic acid bacteria, probiotics and postbiotic derivatives in the maintenance of gut–brain axis homeostasis, with particular attention to their protective functions within the ecological niches they colonise. Their biological activity extends beyond microbial competition with pathogens and includes reinforcement of epithelial barrier integrity, modulation of mucosal and systemic inflammation, production of short-chain fatty acids and neuroactive metabolites, regulation of tryptophan metabolism, interaction with enteric and vagal pathways, and influence on stress-related neuroendocrine circuits. The same conceptual framework also provides a coherent basis for understanding their relevance in urinary tract infections, mucosal resilience, host–pathogen balance and, in selected experimental settings, antiproliferative activity on tumour cells. A psychoneuroendocrinoimmunological perspective further enriches this model by placing the microbiota within a wider regulatory network involving the nervous, endocrine, immune and psychological dimensions of health. Microbial signals may contribute to the modulation of hypothalamic–pituitary–adrenal axis activity, autonomic balance, inflammatory tone and neuroimmune communication, thus acting at the intersection between biological adaptation and vulnerability. The intestine, with some delay finally promoted from “digestive tube” to “systems biology command centre”, becomes a privileged observatory for studying how resilience is constructed, maintained or lost. The lecture will therefore propose an integrated interpretation of gut bacteria as ecological, biochemical and immunoregulatory agents involved in the preservation of gut–brain axis homeostasis. Within this view, probiotics and postbiotics should not be considered simple adjunctive interventions, but biologically active tools capable of illuminating the mechanisms through which microbial communities influence host resilience, neuroimmune regulation and systemic equilibrium.

**Keywords:** gut–brain axis; gut microbiota; probiotics; postbiotics; lactic acid bacteria; neuroimmune communication; hypothalamic–pituitary–adrenal axis; host–microbe interaction.