



13-14 November 2025

FUNCTIONAL BIOTICS AND GUT BARRIER: TRANSLATIONAL PERSPECTIVES FROM PREBIOTICS TO POSTBIOTICS

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Abstract: *Functional biotics—prebiotics, probiotics, synbiotics, and postbiotics—represent a unified strategy to maintain intestinal barrier integrity and immune balance. Recent evidence (2022–2025) shows they modulate tight-junction expression, short-chain fatty acid (SCFA) synthesis, and inflammatory signaling. Postbiotics, consisting of non-viable microbial metabolites, emerge as stable, safe alternatives to live probiotics. Translational studies highlight their potential to prevent gut inflammation, metabolic dysfunction, and dysbiosis-related disorders in both human and veterinary medicine.*

• Introduction

The intestinal barrier is a dynamic interface linking microbial ecology, immune defense, and metabolic regulation. Disruption leads to inflammation, obesity, and IBD. Modern approaches shift from pathogen exclusion to microbiome modulation. Functional biotics target barrier reinforcement, mucosal immunity, and microbial homeostasis, redefining nutrition as a therapeutic tool.

• Results and discussions

Recent trials confirm improved barrier function, reduced endotoxemia, and enhanced immune tolerance. Veterinary applications show reduced diarrhea and improved feed efficiency, aligning with One Health and antibiotic-reduction strategies.

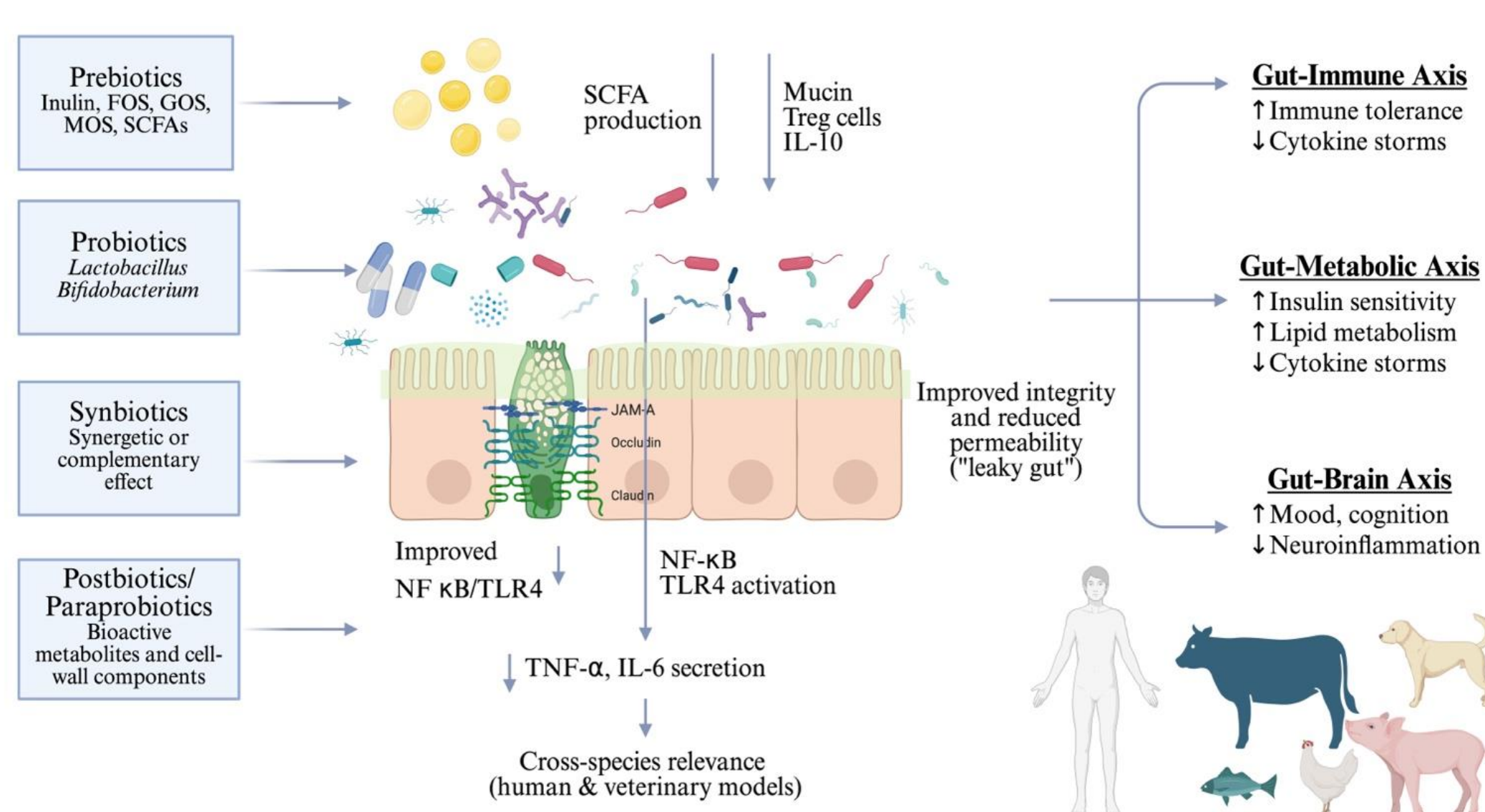


Figure 1. Interconnected Actions of Functional Biotics on the Gut-Immune-Metabolic-Brain Axes

• Material and method

A structured review of studies published between 2022 and 2025 was performed using PubMed, Scopus, and Web of Science databases. Inclusion criteria: interventions with pre-, pro-, syn-, or postbiotics assessing gut barrier or immune outcomes in humans or animals. Data were extracted on molecular mechanisms, clinical endpoints, and translational applications.

Category	Studies (2022-2025)	Human	Animal	Main Outcome
Prebiotics	12	7	4	↑ SCFAs, ↓ pathogens
Probiotics	18	10	6	↓ permeability, ↓ cytokines
Synbiotics	9	6	2	↑ mood, ↑ feed efficiency
Postbiotics	10	7	3	↑ mucin, ↓ NF-κB, ↑ IgA

• Conclusions

Functional biotics bridge diet, microbiota, and immune health. Their translation from human to veterinary contexts demonstrates broad preventive potential. Postbiotics offer standardized, safe formulations for sustainable, precision microbiome therapy.

Acknowledgement: Presented within "Young People and Multidisciplinary Research in Applied Life Sciences," University of Life Sciences "King Mihai I" from Timișoara, 13–14 November 2025.