# Harnessing Gut Microbiota for Longevity: Insights into Mechanisms and Genetic Manipulation.


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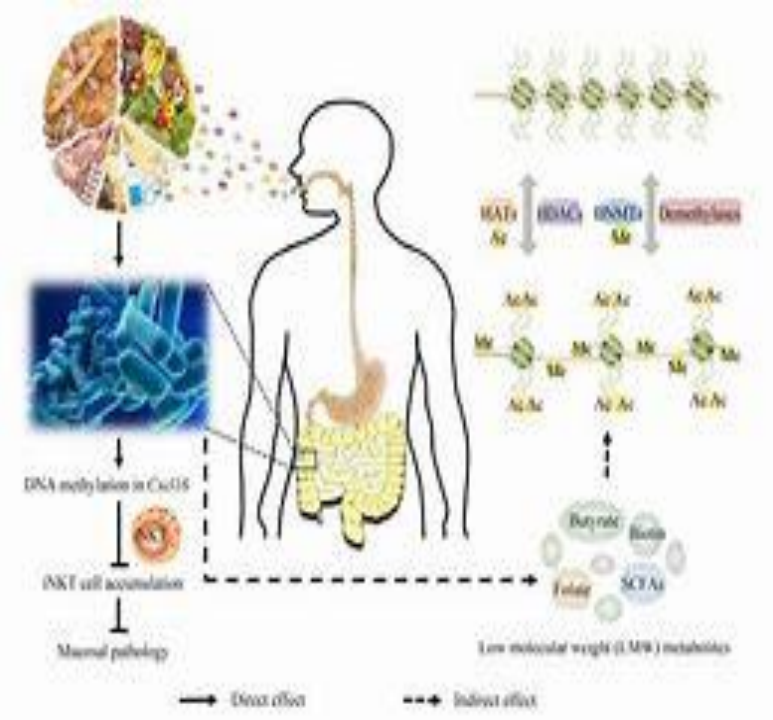
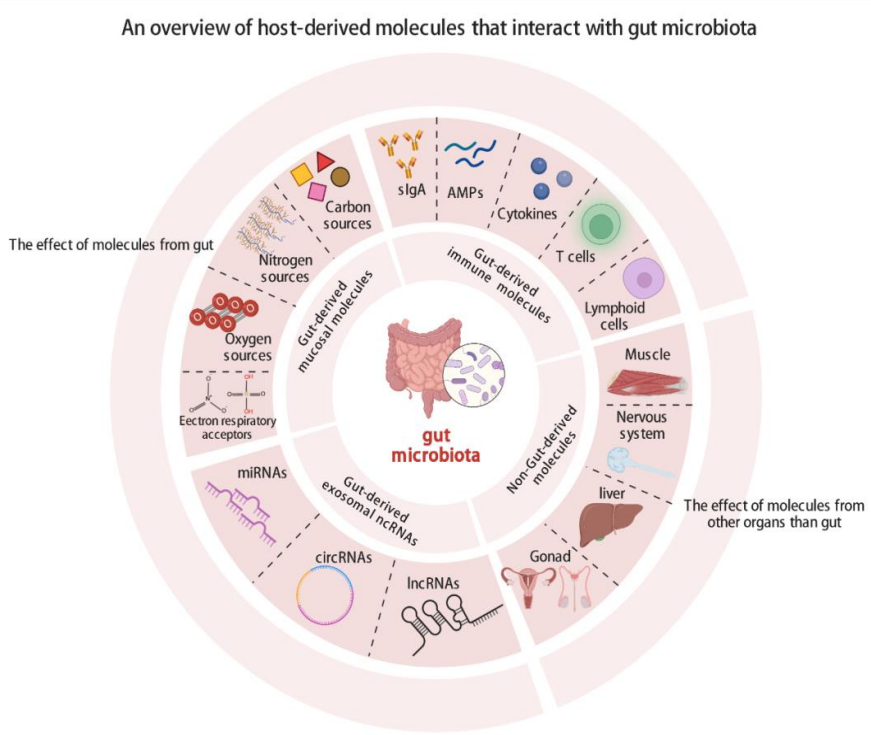
# Introduction

The intricate relationship between microorganisms and their host is fundamental to many physiological processes in multicellular organisms.



Gut microbiota accounts for 95% of symbiotic microorganisms

Gut microbiota is established at birth and continuously evolves.




Influenced by various internal and external factors, such as nutrition, lifestyle, sex, and physiology, leading to individual heterogeneity and distinct functions in host.

# Highlights

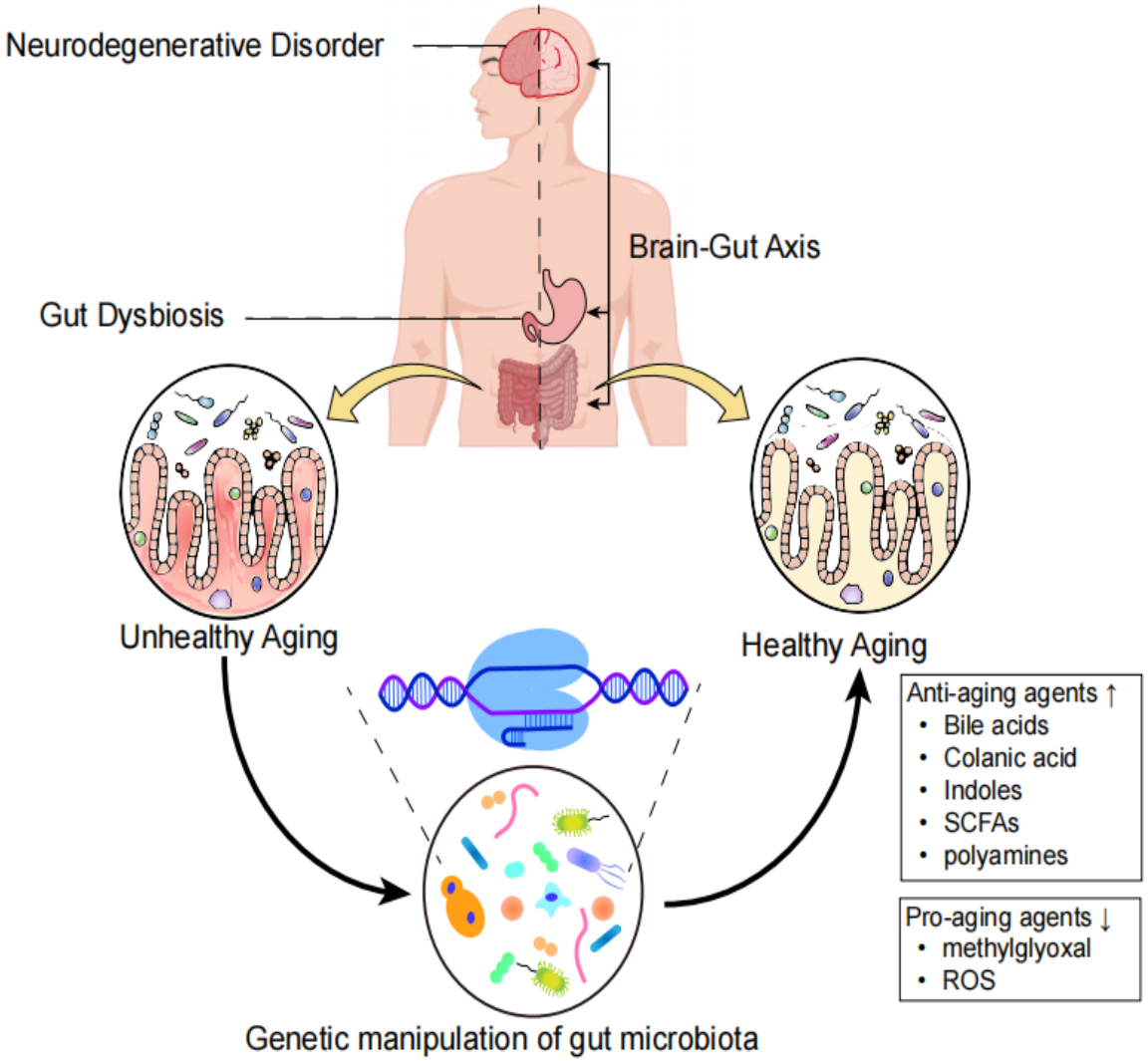



Figure 3. Overview of Gut Microbiota's Role in Aging and Potential for Genetic Manipulation

This review explores the intricate relationship between gut microbiota and host longevity, emphasizing the regulatory mechanisms through which microbial metabolites influence aging pathways.

It discusses substrates-based interventions, focusing on microbial-derived compounds and engineered probiotics to combat chronic inflammation, neurodegenerative disorders, and other age-related conditions.

It highlights the potential of precise genetic manipulation of gut microbiota through metagenomic engineering as a promising strategy to enhance healthy aging and treat age-related diseases.

# Mechanisms of longevity regulation by gut microbes

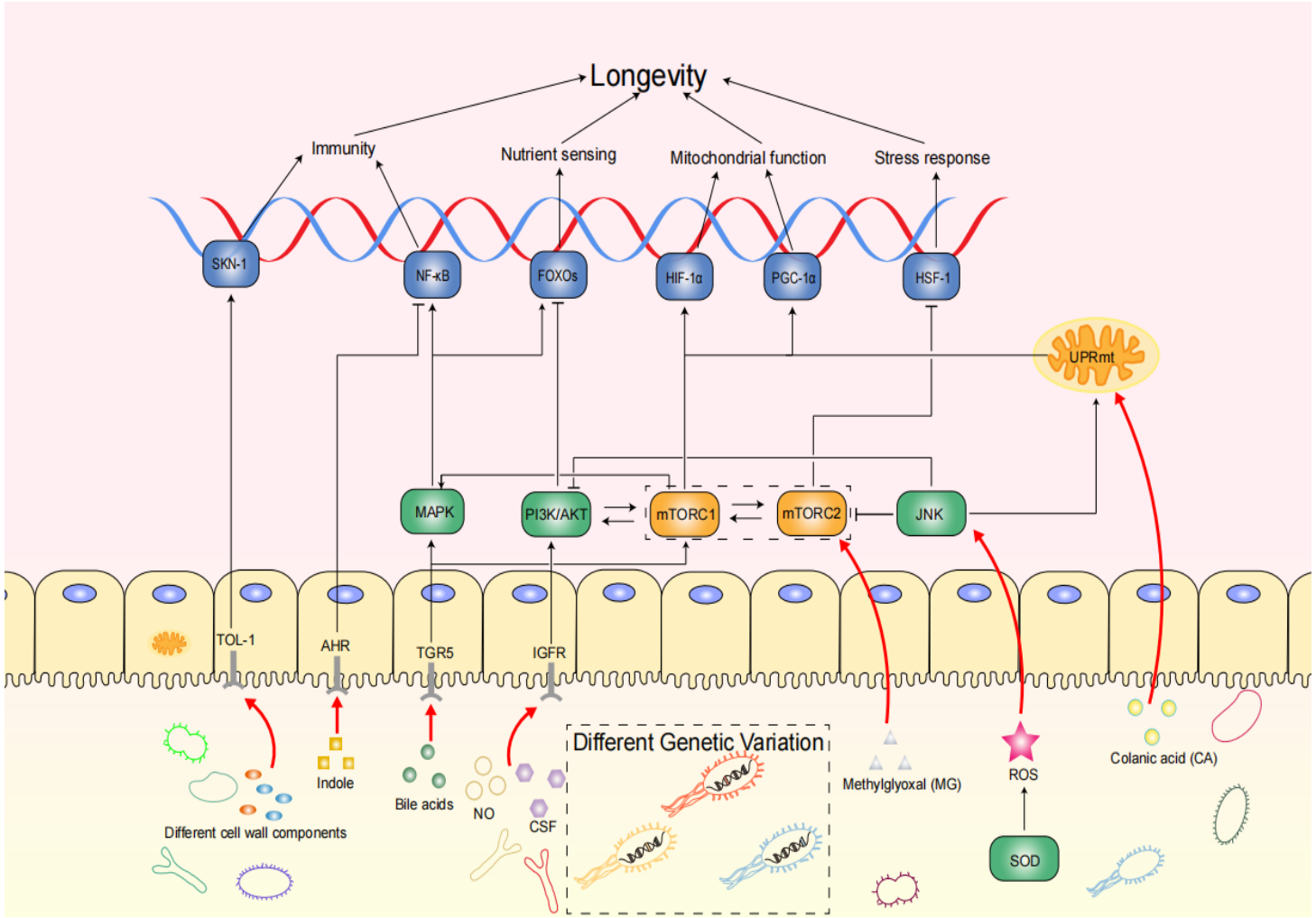



Figure 1. Mechanisms of Longevity Regulation by Gut Microbes

The aging process is regulated by an intricate network of signaling pathways, influenced by various genetic and environmental factors.

# Substrates-based interventions to treat age-related diseases

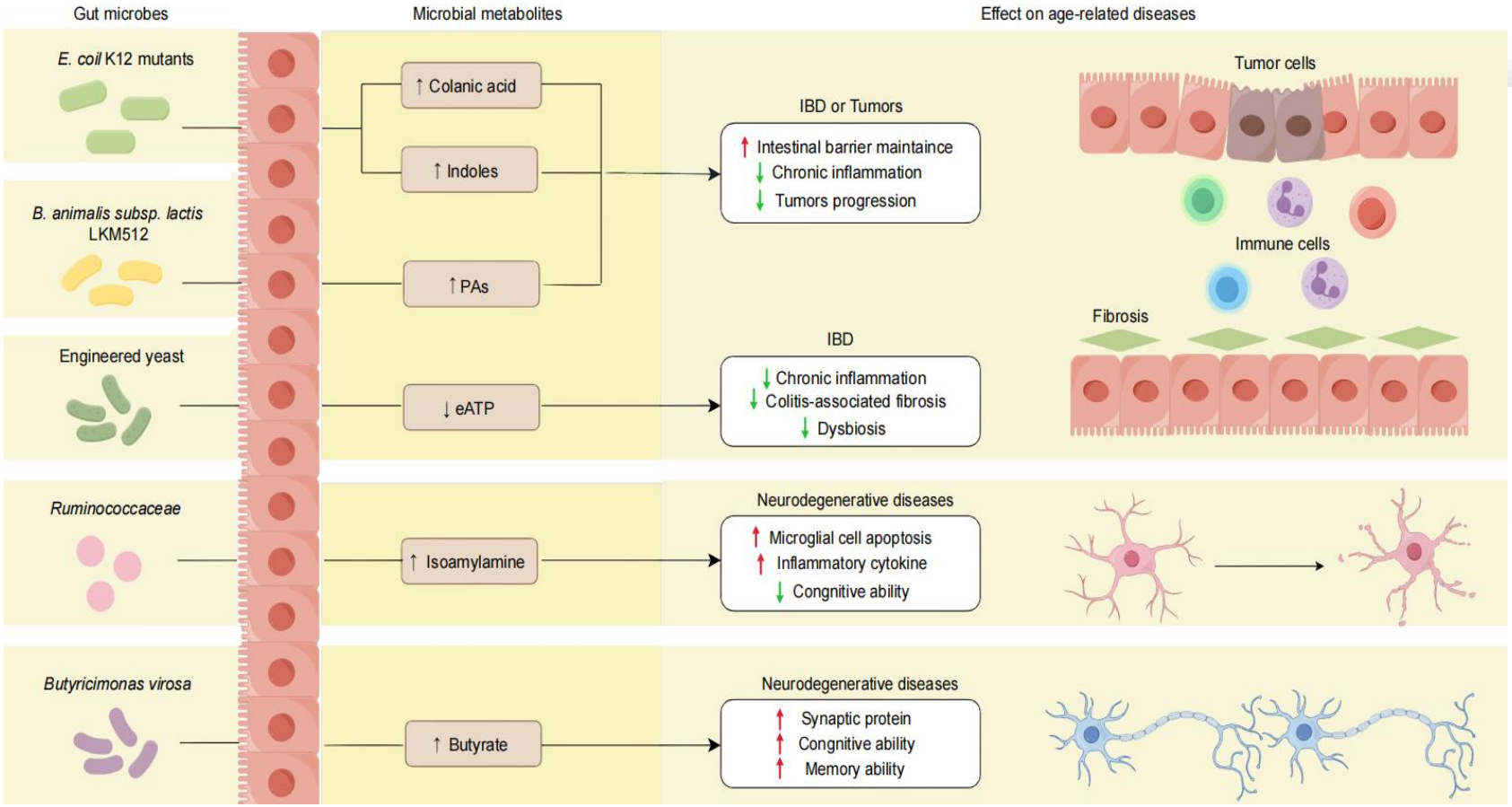



Figure 2. Substrates-based interventions to treat age-related diseases

Changes in the gut microbiota during aging are closely linked to these age-related diseases, especially those associated with gut dysbiosis, which can exacerbate chronic inflammation and neurodegenerative conditions.

# Metagenomic engineering of gut microbiota: manipulating gut microbial genetic variation to prolong host longevity

MAGIC is a platform designed to genetically modify gut microbiota directly within their native habitat through horizontal gene transfer.

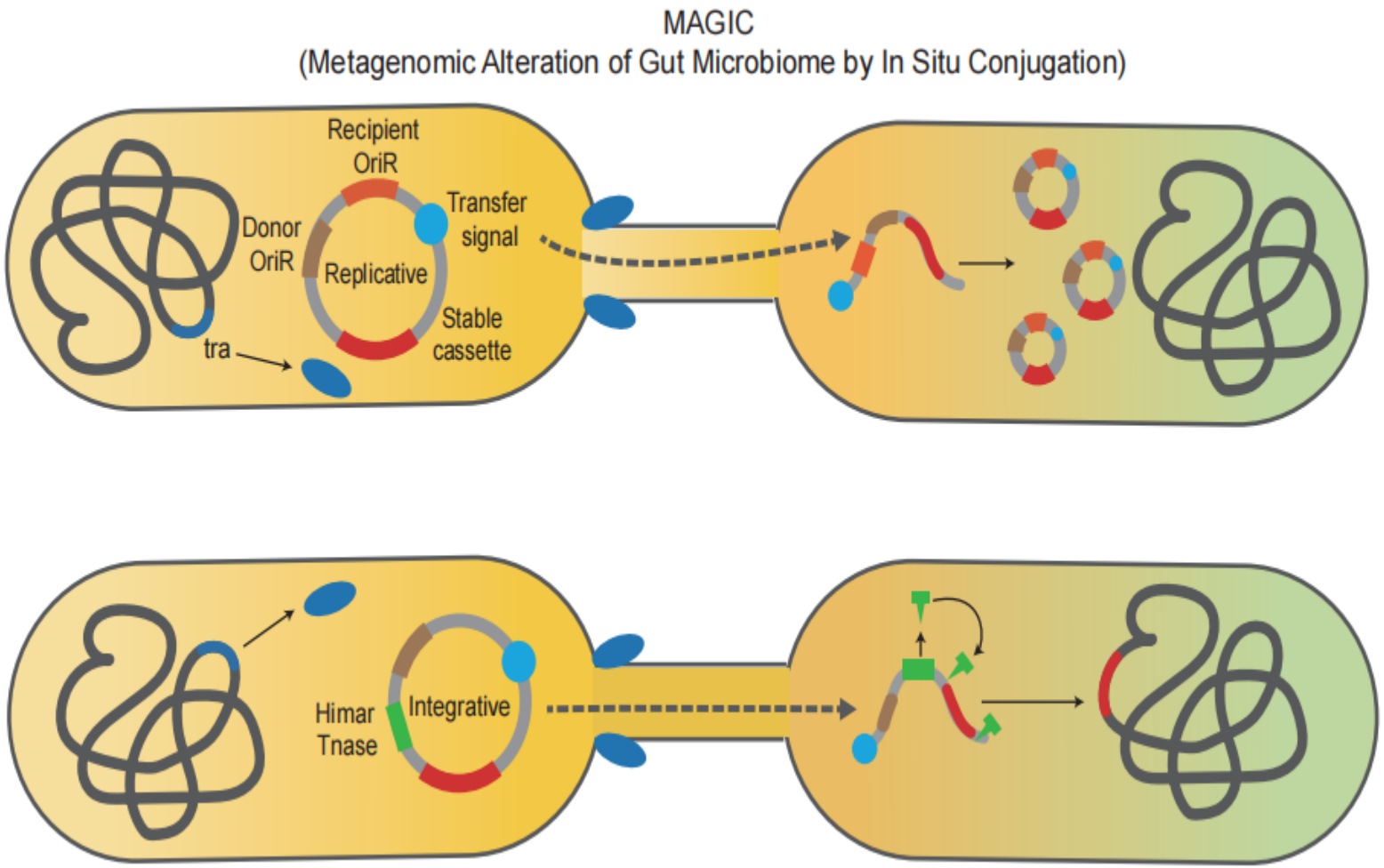



Figure 4. MAGIC (Metagenomic Alteration of Gut Microbiome by In Situ Conjugation)

# Metagenomic engineering of gut microbiota: manipulating gut microbial genetic variation to prolong host longevity

Phage-delivered CRISPR-Cas9 is a technology that utilizes engineered bacteriophages to deliver CRISPR-Cas9 systems to specific bacterial strains within the gut microbiome.

INTEGRATE is a CRISPR-based system that enables highly efficient and precise insertion of kilobase-sized DNA sequences into bacterial genomes.

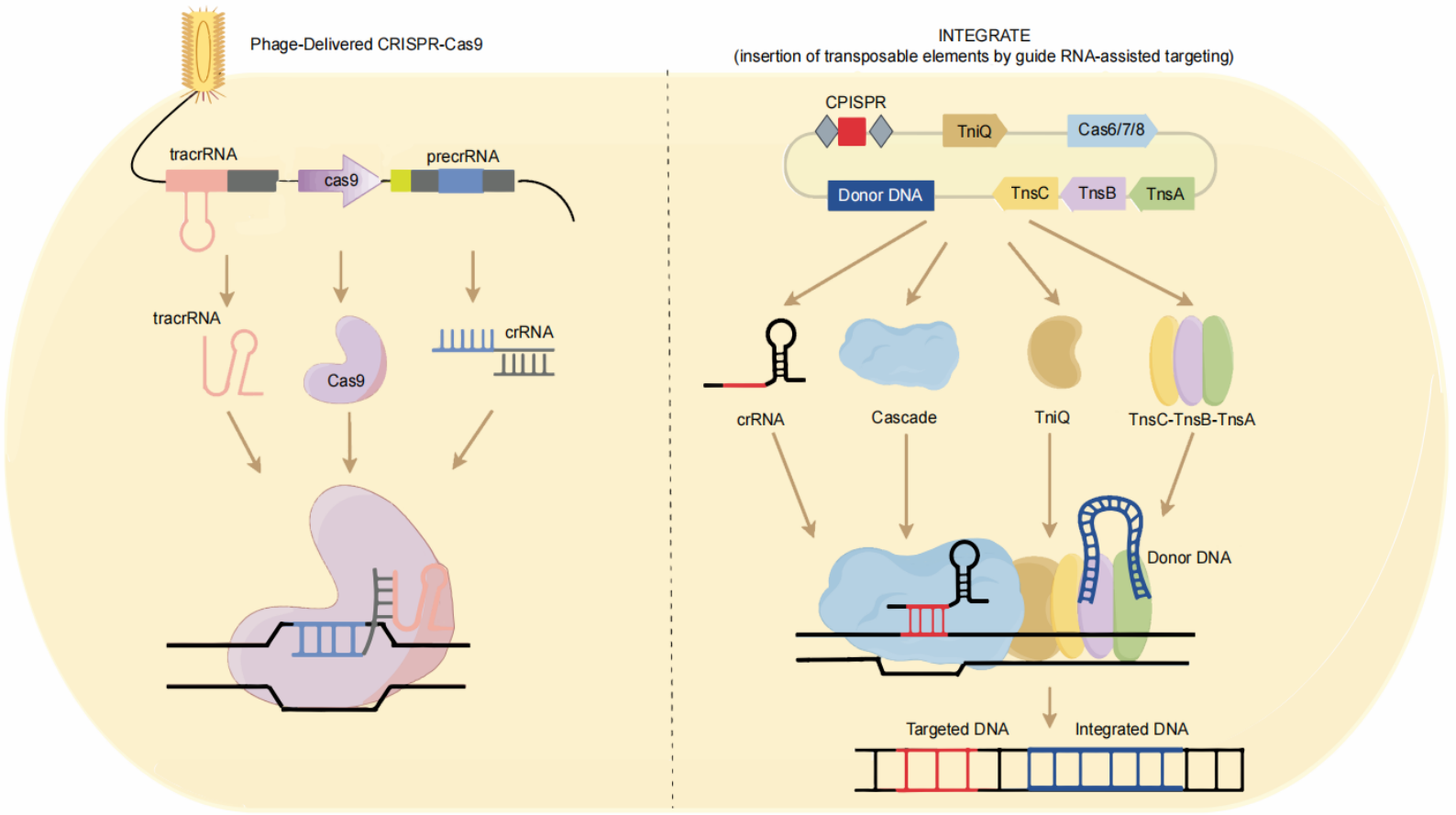
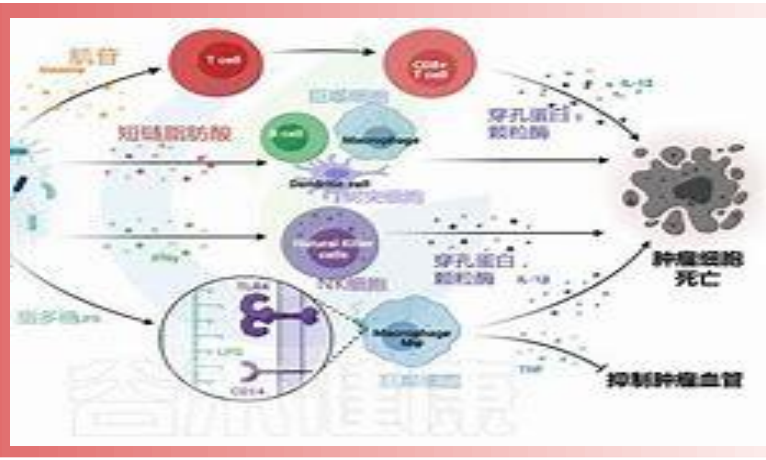



Figure 4. Phage-Delivered CRISPR-Cas9 and INTEGRATE (insertion of transposable elements by guide RNA-assisted targeting)

# CONCLUSION

This review highlights a novel approach centered on the metabolites produced by gut microbiota, demonstrating the potential of utilizing these microorganisms to maintain health and extend lifespan.




Focusing on the functional assessment of specific microbial metabolites through high-throughput screening could provide a promising pathway for developing effective drugs aimed at enhancing host health and promoting a healthy lifespan.

Advancements in gut microbial gene editing techniques present an exciting frontier in the development of more precise and feasible therapeutics to combat age-related diseases and promote longevity.

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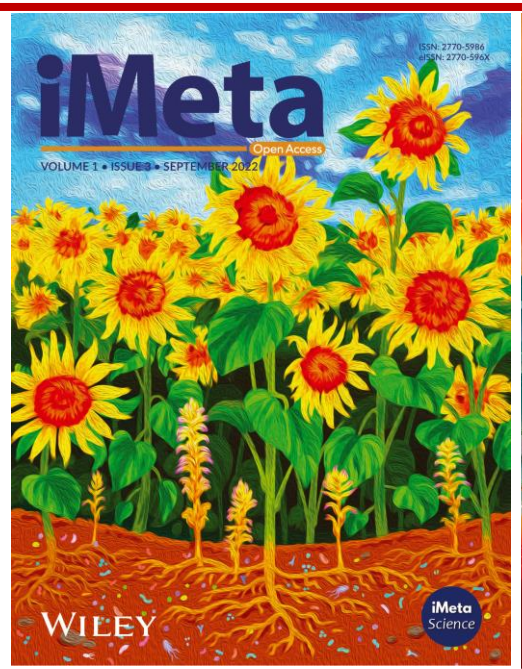


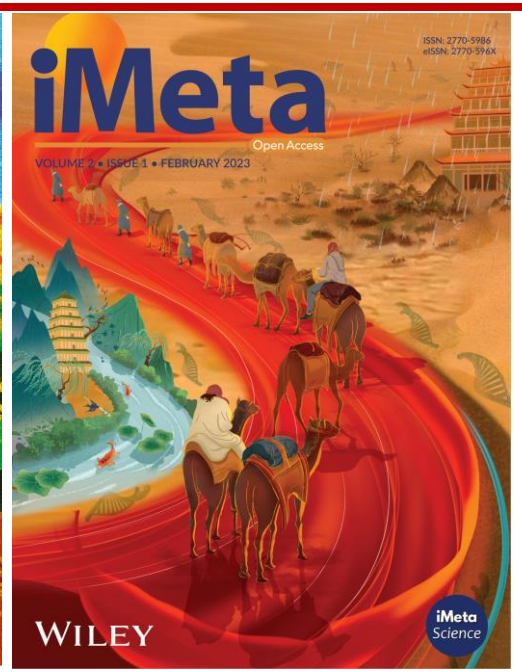




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