The Microbiome in Cancer

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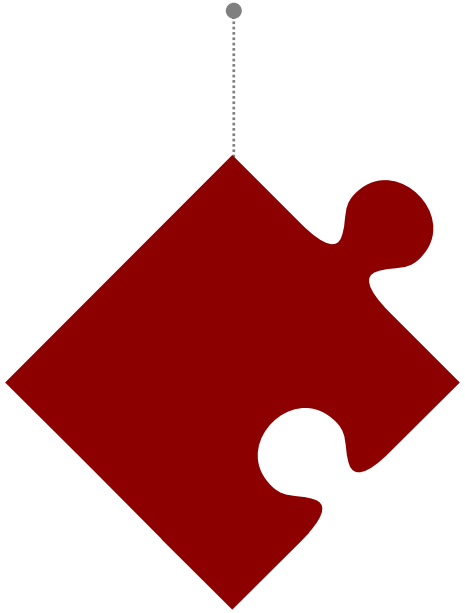
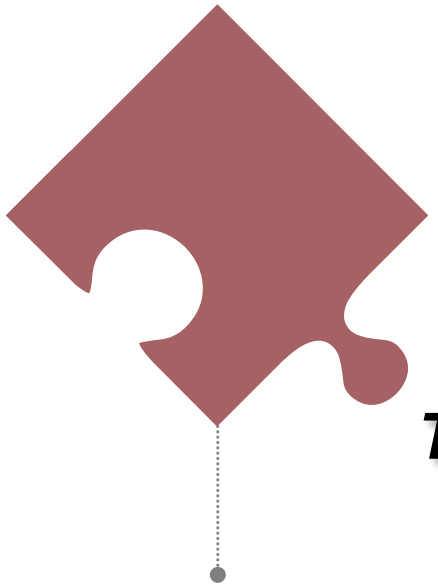
Introduction

Microorganisms promote the occurrence and development of tumors

- Gut microbiome
- Intratumor microbes
- Microorganisms in various organ tumors





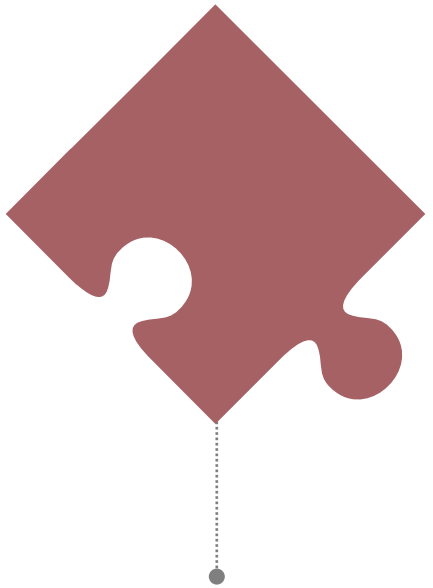
The microbiome can be used as a biomarker for diagnosis and prognosis

- Early Diagnosis
- Assessment of prognosis
- Prediction of efficacy

The Microbiome in Cancer

Microorganisms influence treatment effectiveness

- Chemotherapy
- Radiation therapy
- Immunotherapy
- Targeted Therapy
- Surgical treatment



Therapies targeting microbes are recognized as effective for anticancer effects

- Probiotics, prebiotics, and synbiotics
- Fecal microbiota transplantation
- Antibiotics
- Diet
- Microbial-targeted Drugs
- Oncolytic virus
- Engineered bacteria
- Fungal treatment

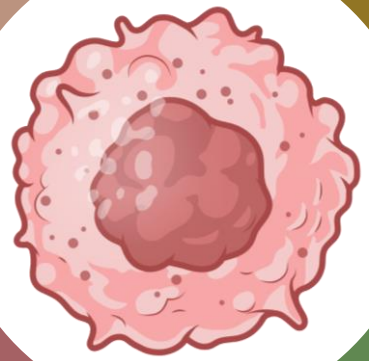
Gut microbiome and tumorigenesis

Bacteria (Table 1)

- **Beneficial bacterium:** Most reduce the risk of cancer.
- **Pathogenic bacterium:** Most can accelerate cancer progression; Abnormal proliferation can be involved in the process of carcinogenesis.

Virus (Table 2)

- **Oncogenic viruses:** Induce damage to genetic material and promote dysregulation of the microbiota.
- **Bacteriophages:** Affect the progression of cancer and interact with cancer cells.
- **Other viruses:** Directly or indirectly involved in tumor development.



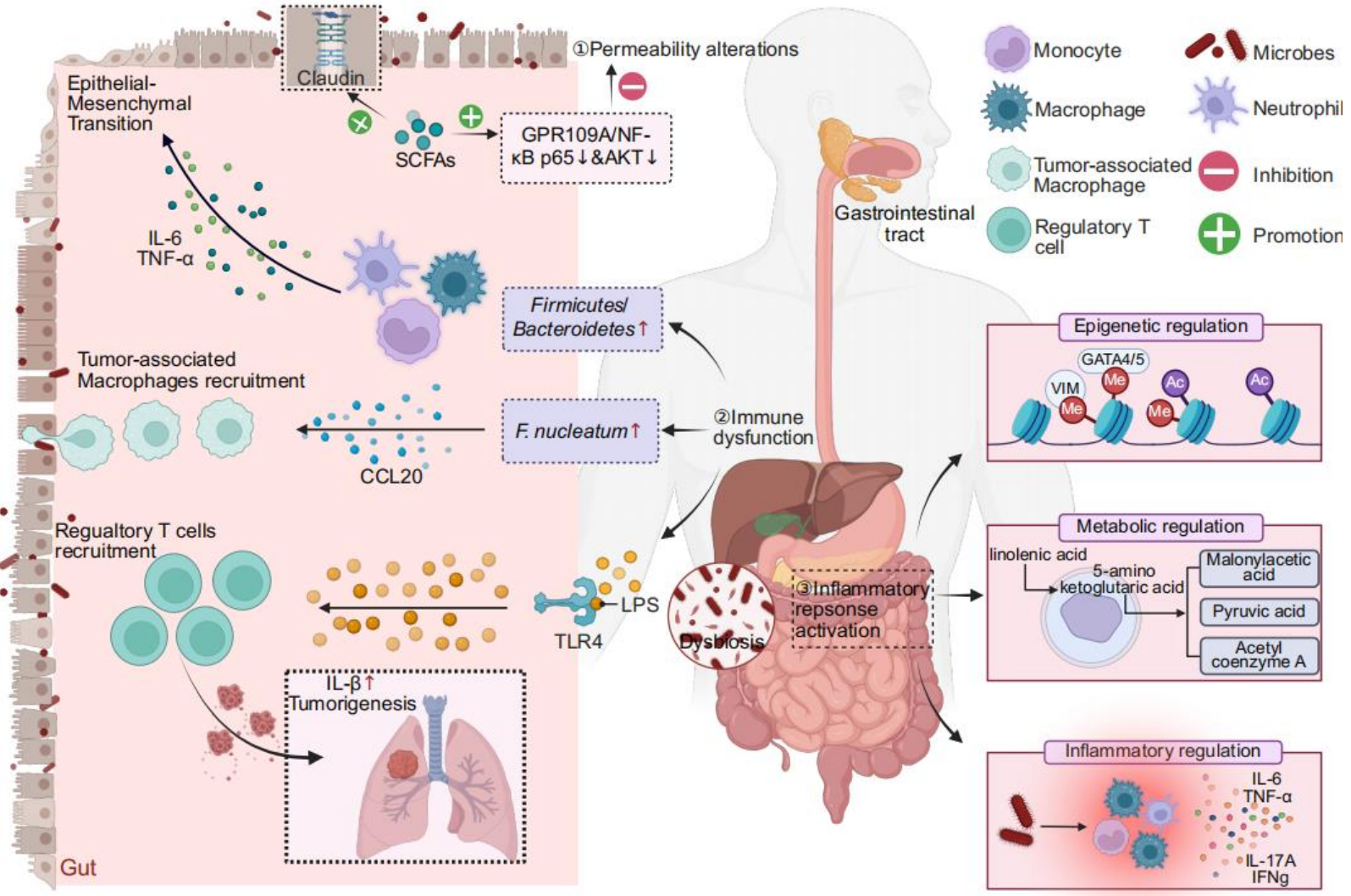
Fungus (Table 3)

- **Symbiotic fungi:** The imbalance of symbiotic fungi promotes the occurrence and development of digestive system tumors.
  - Regulate the host immune microenvironment
  - Interaction with bacteria
- **Pathogenic fungi:** Specific pathogenic fungi were significantly enriched in multiple cancers.

Microbial metabolite (Table 4)

- **Short-chain fatty acids (SCFAs):** Affect tumor progression through multiple molecular mechanisms; regarded as a potential target for cancer treatment.
- **Secondary bile acids:** Play a role in promoting or inhibiting cancer.
- **Tryptophan metabolites:** Closely related to the changes of intestinal barrier function.

Gut microbiome and tumorigenesis



Permeability alterations&microbes entry

- Promote the **translocation of intestinal flora**
- Induce the **inflammatory cascade**
- Increase exposure to **carcinogens**

Immune dysfunction

- **Proinflammatory factors:** Promote epithelial-mesenchymal transition
- **Chemokine CCL20:** Recruit tumor-associated macrophages
- **Gut-lung axis:** The cross-organ immune response

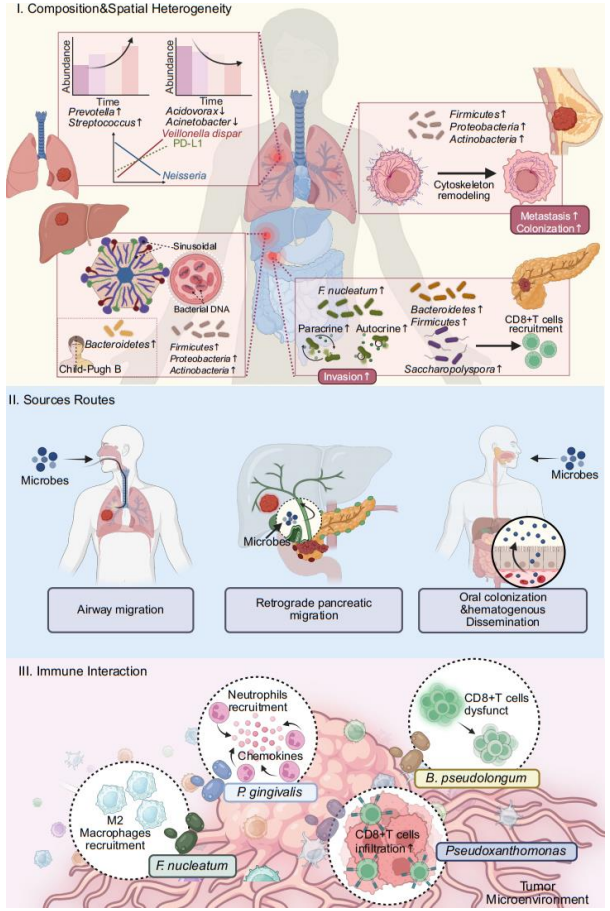
Inflammatory response activation

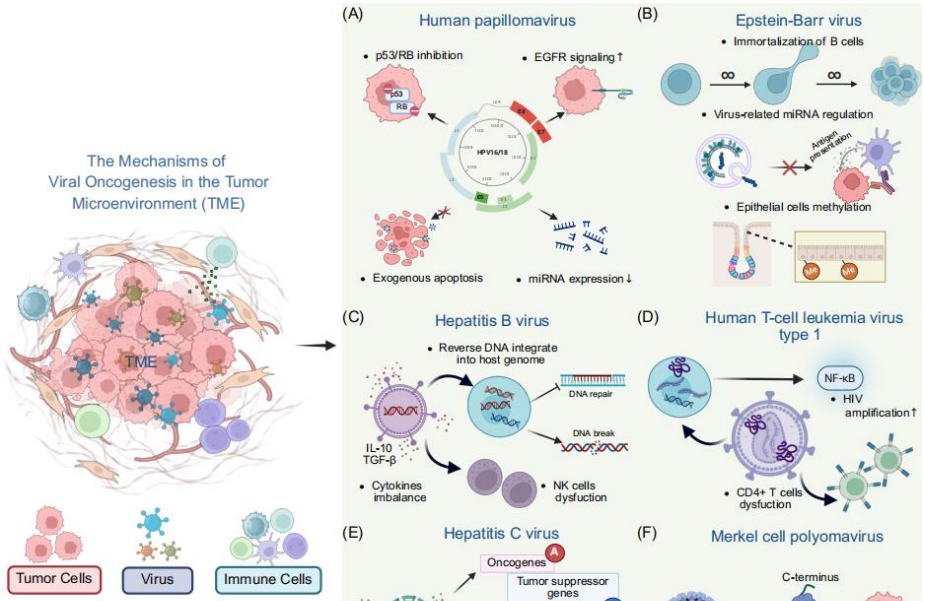
- Altering **epigenetic mechanisms**
- Regulating **metabolic pathways**
- Regulating the levels of **proinflammatory factors**

Tumor-associated microbiome

Intratumor microbes are involved in carcinogenesis

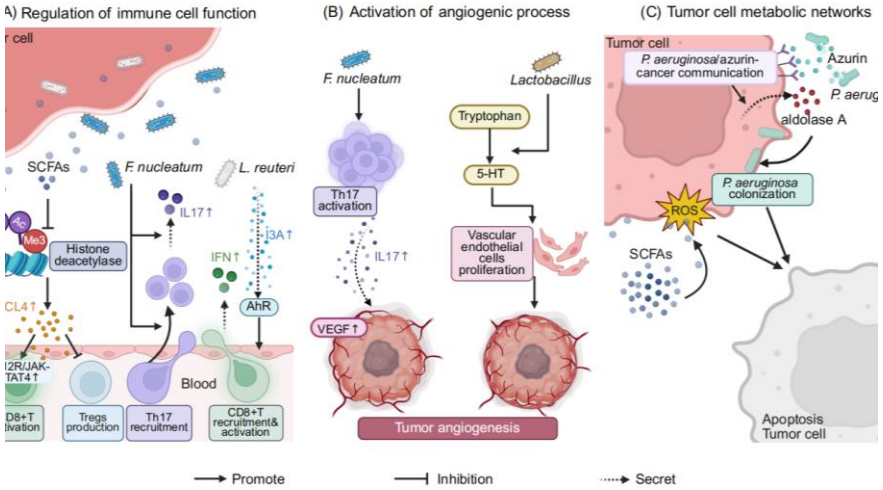
- Bacterial community composition was heterogeneous
- Bacteria interact with the tumor microenvironment





Intratumoral fungi are involved in tumor progression

- Specific distribution of fungi
- Interaction between fungi and tumor immune microenvironment
- Fungi mediate metabolic reprogramming of tumors



Intratumoral virus promotes tumor development

- Specific patterns of infection
- Genome modification
- Mechanisms of immune escape

Microbial metabolites can Influence tumor fate

- Regulating immune cell function
- Involved in the angiogenic process
- Regulating tumor cell metabolism

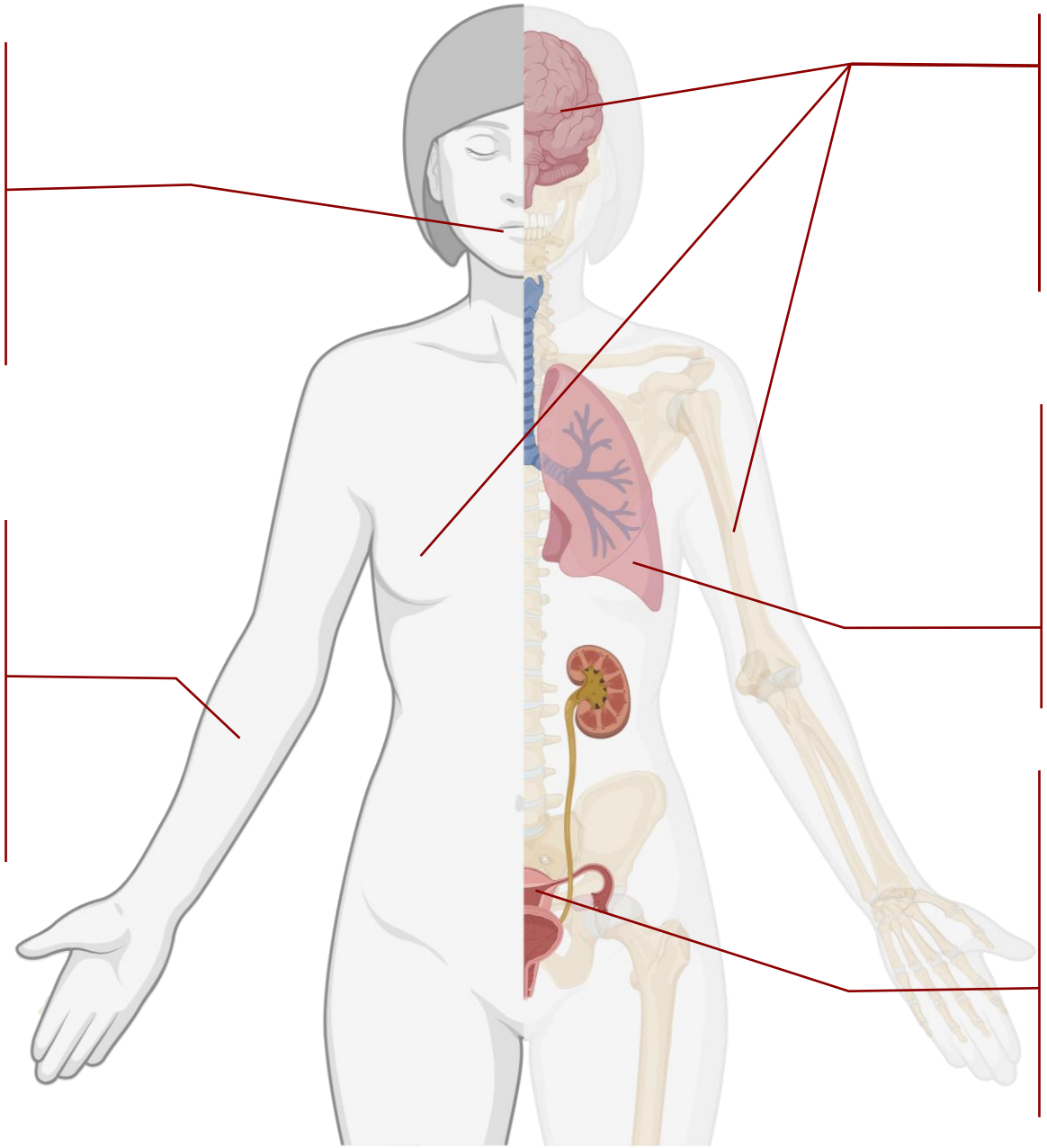
Organ-specific microbiome and tumors

oral cavity

- Imbalance of the **oral microbiome**
- **Bacteria:** Specific bacteria proliferate abnormally
- **Virus:** HPV infection
- **Fungi:** Colonization of fungi
- **Microbial metabolites**

Skin

- Dysregulation of the **microbiome**
- **UV:** Radiation alters microbes
- **Virus:** Virus infection
- Microbes mediate the **inflammatory response**
- Microbiome influences **immunotherapy**



Other Organs

- Imbalance of the breast microbiome → **Breast cancer**
- Alterations of the brain microbiome → **Brain tumors**
- Bone marrow microbiome → **Hematological malignancies**

Respiratory system

- Imbalance of the **microbiota**
- **Specific microbiota：** Promote lung cancer progression
- The microbiome regulates the **tumor immune microenvironment**
- Microbiome modulates the **prognosis** of lung cancer

Urogenital system

- Imbalance of gut microbiota homeostasis → **bladder cancer**
- Specific bacterial infections → **Prostate cancer**
- HPV→ **Cervical cancer**
- Microbiome → **Antineoplastic therapy**
- Microbiome markers → **Prognosis** in urologic tumors

(Table 5)

Microbiome in tumor diagnosis

Microbiome markers

(Table 6)

Markers of bacteria

- Specific flora
- Indicators of bacterial diversity
- Bacterial metabolites

Viral markers

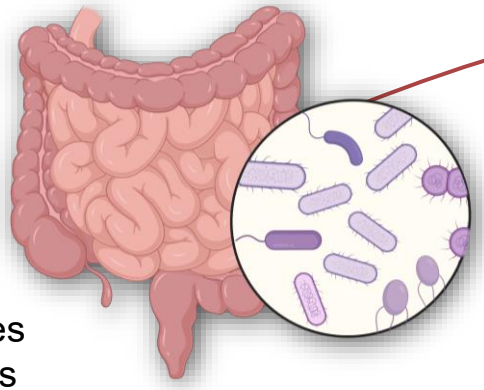
- Viral infection indicators
- Viral load
- Antigen of virus

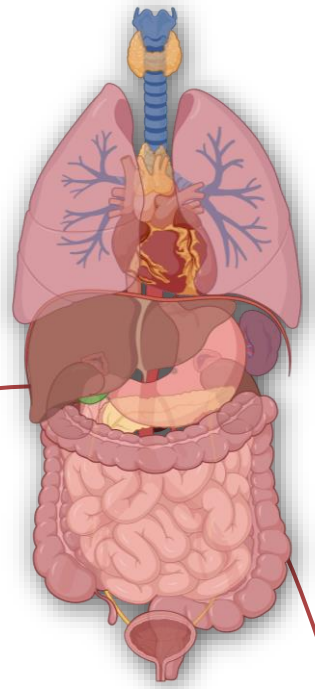
Fungal markers

- Characteristics of fungal communities
- Fungal metabolites

Microbial metabolite markers

Inflammation-related markers

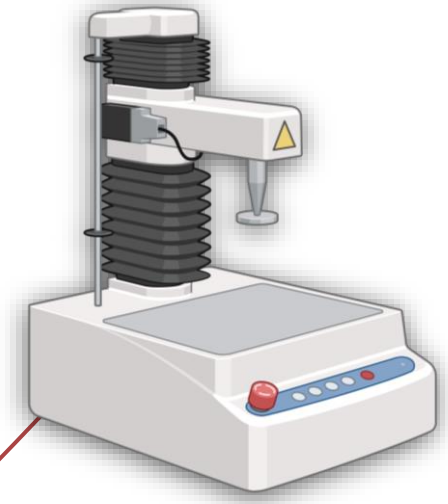


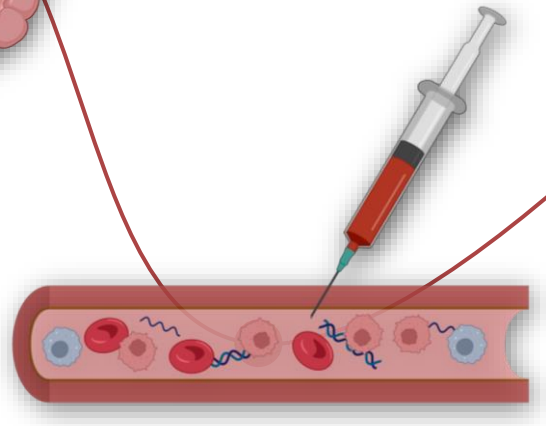


Organ specific microbes

(Table 7)

- Oral microbial markers
- Skin microbial markers
- Urinary microbial markers
- Respiratory Microbial markers





Liquid biopsy and microbiome markers

- Circulating Microbial DNA
- Microbial-derived exosomes

Standardization of microbiome diagnostics

- Specification of sample collection and processing
- Standardization of detection methods

Microbiome and cancer prognosis & efficacy

Microbiome and cancer prognosis

- Diversity of Microorganisms
- Specific microbial species
- Microbial metabolites

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AND

(Table 8)

The microbiome and cancer response

- Efficacy
- Drug resistance
- Adverse reactions

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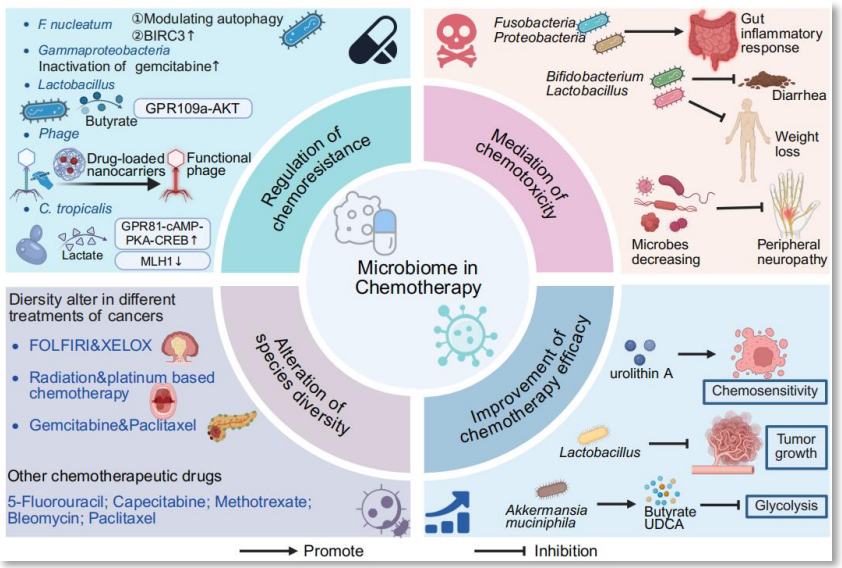
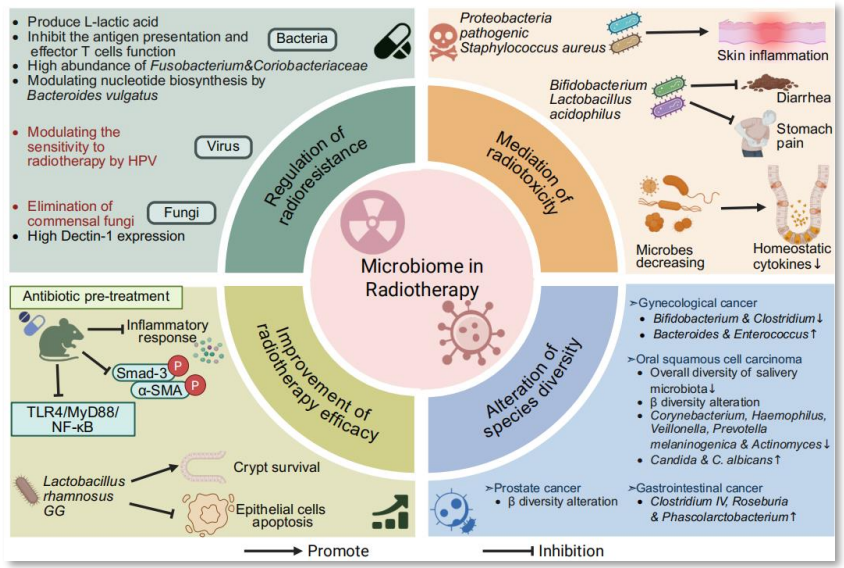
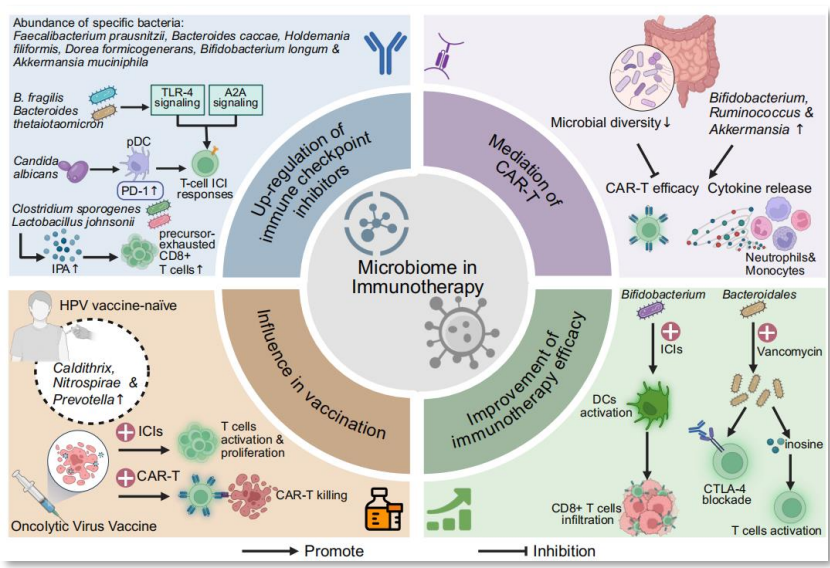
Microbiology and cancer therapy







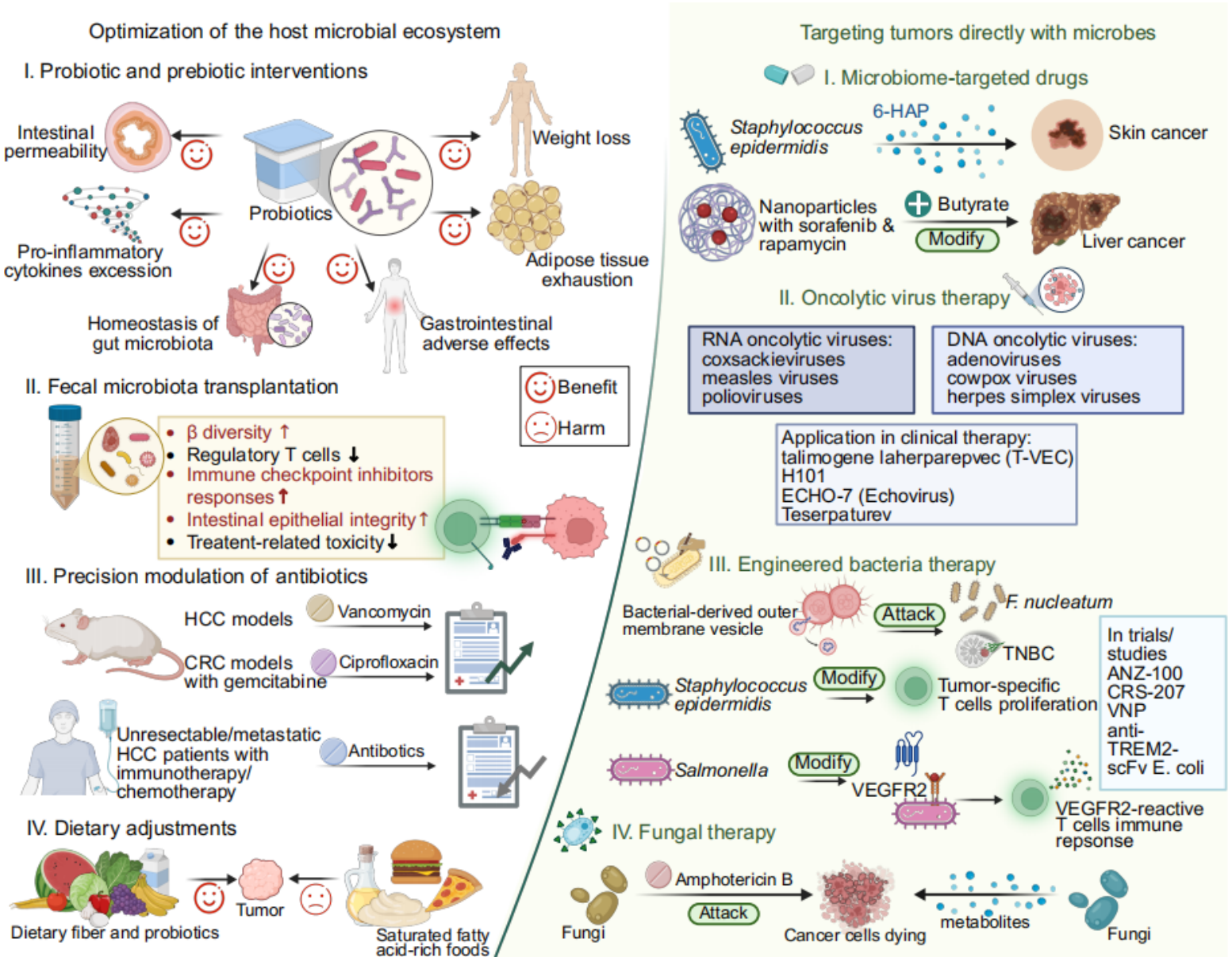
Microbiome and targeted therapies

- Influence on efficacy
- Affecting drug resistance
- Targeted therapy strategies combined with microbiome intervention

Microbiome and surgical treatment

- Preoperative microbiome preparation
- Surgical stress affects the host microbiome
- Microbiome affects postoperative complications
- Microbiome regulation promotes recovery

Microbiology and cancer therapy



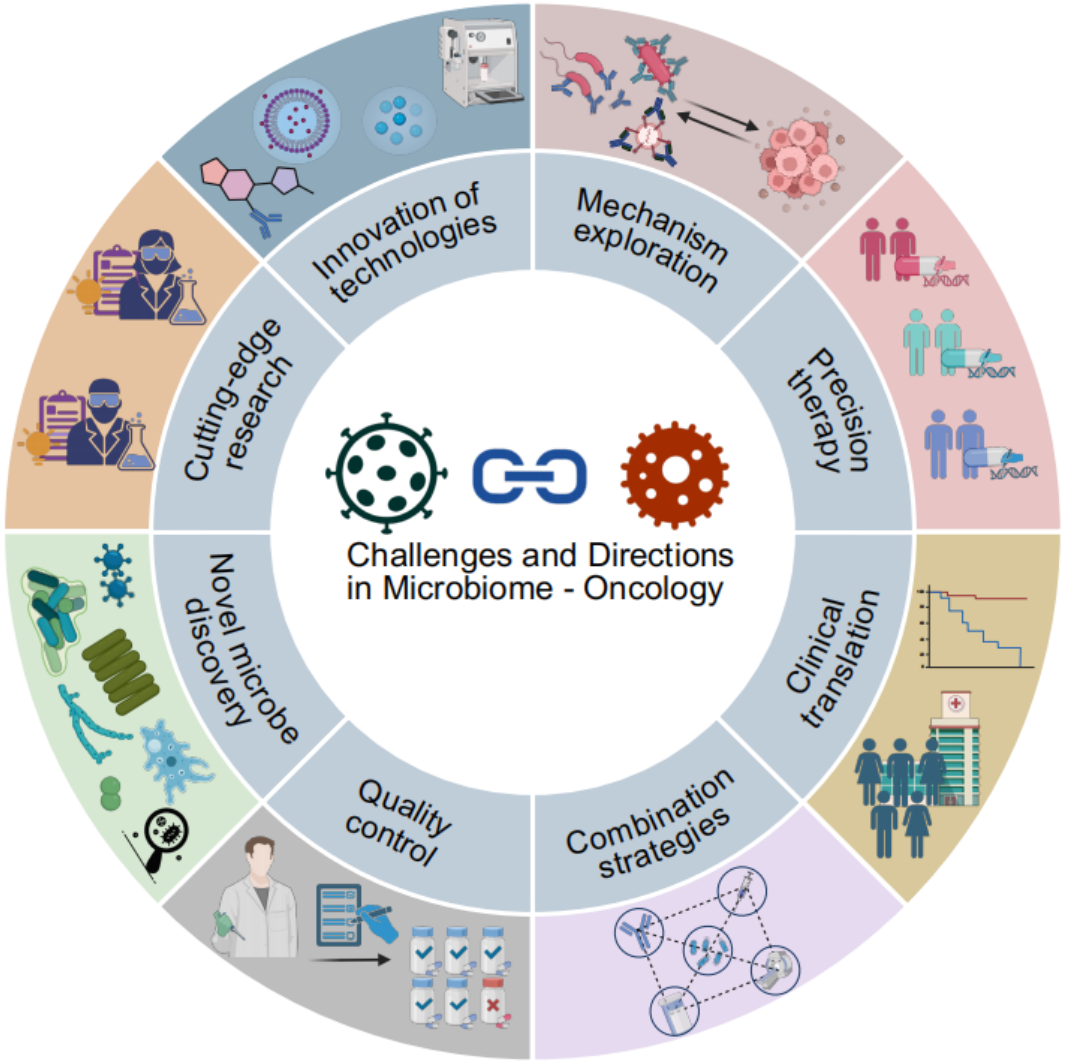
Host microbial ecosystem optimization

- Probiotic, prebiotic and synbiotic
- Gut Microbiota Transplantation (FMT)
- Regulation of antibiotics
- Regulation of diet

Microbes directly target tumors

- Microbiome-targeted drugs
- Oncolytic viral therapy
- Engineered Bacterial Therapy
- Fungal treatment strategies

Development and innovation in microbiome research



- **Technology**: Development and innovation of microbiome research technology
- **Mechanism**: In-depth exploration of the mechanism of microbiome action
- **Precision therapy**: Development of precision microbiome therapeutic strategies
- **Combination therapy**: Optimization of microbiome combination therapy strategies
- **Clinical translation**: Advancing translational clinical research
- **Quality control**: Microbiome product development and regulation
- **Cutting-edge research**: Prospect of frontier research direction
- **Novel microbe**: New directions for microbiome research

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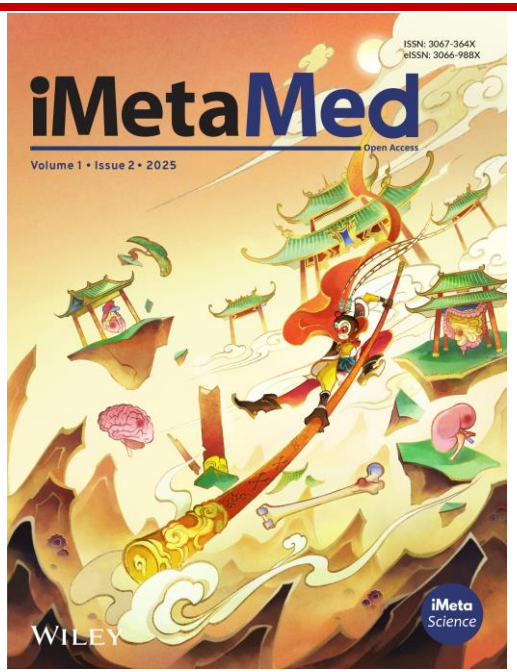

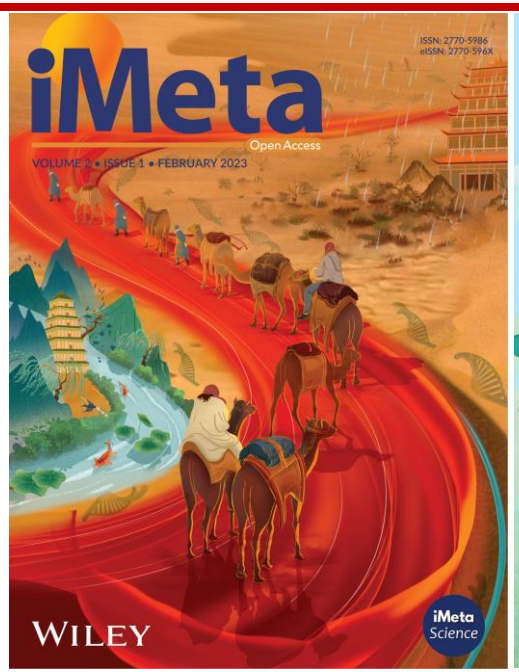

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