



Integrating Gut and IgA-Coated Microbiota to Identify *Blautia* as a Probiotic for Enhancing Feed Efficiency in Chickens

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Introduction

- China leads the world in broiler production, with **12 billion** birds annually and a production value over **250-billion-yuan**, accounting for approximately **10%** of the total output value of the livestock industry.

Feed efficiency

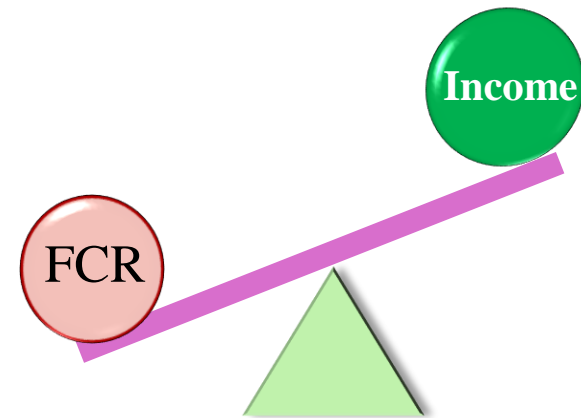
- RFI
- FCR
- ADG
- ADFI
-

- Feed represents **70%** of total production costs in poultry

Feed efficiency is the foundation for determining farming profitability

- **Feed Conversion Ratio (FCR):** Represents the amount of feed consumed to produce a unit of product weight.
- Lower FCR values indicate higher feed efficiency and better farming profitability.

Improving feed efficiency in chickens is one of the key scientific challenges in the poultry industry

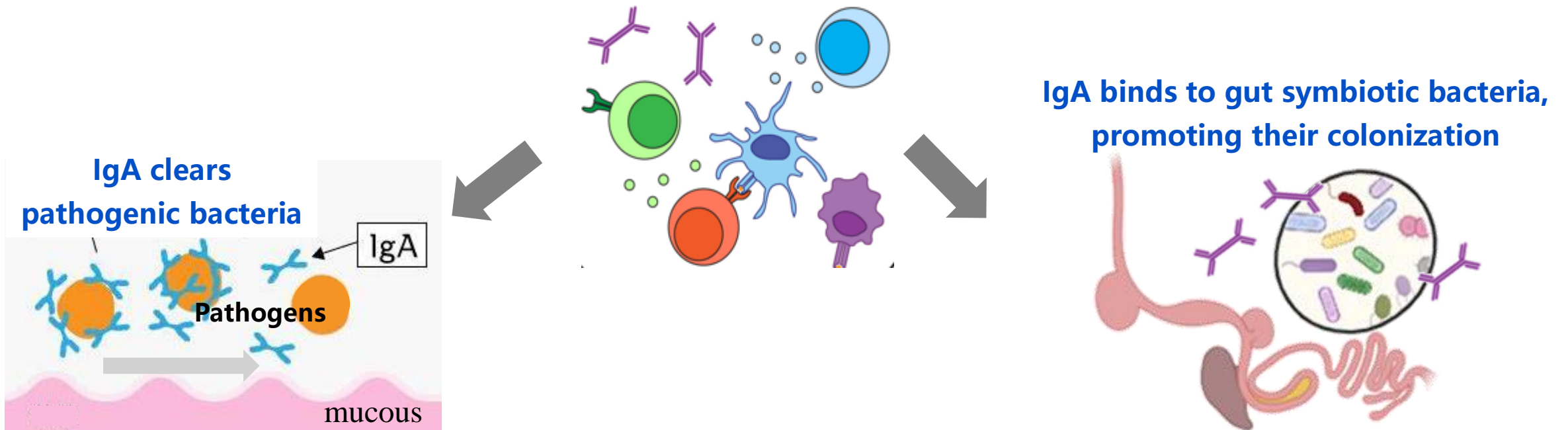




Introduction

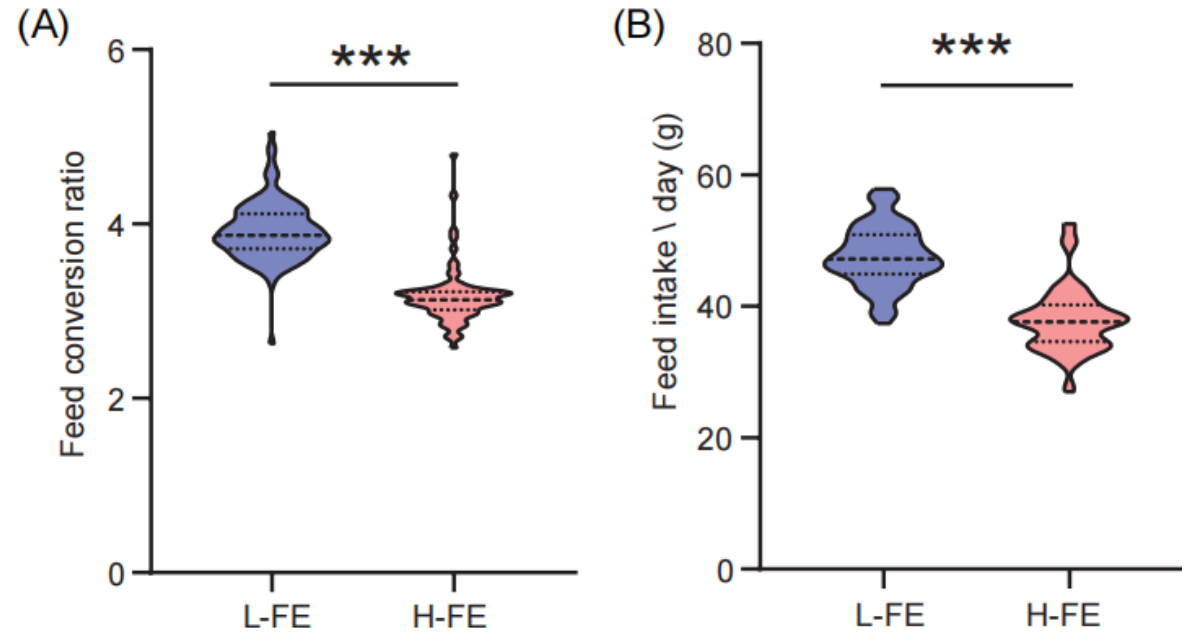
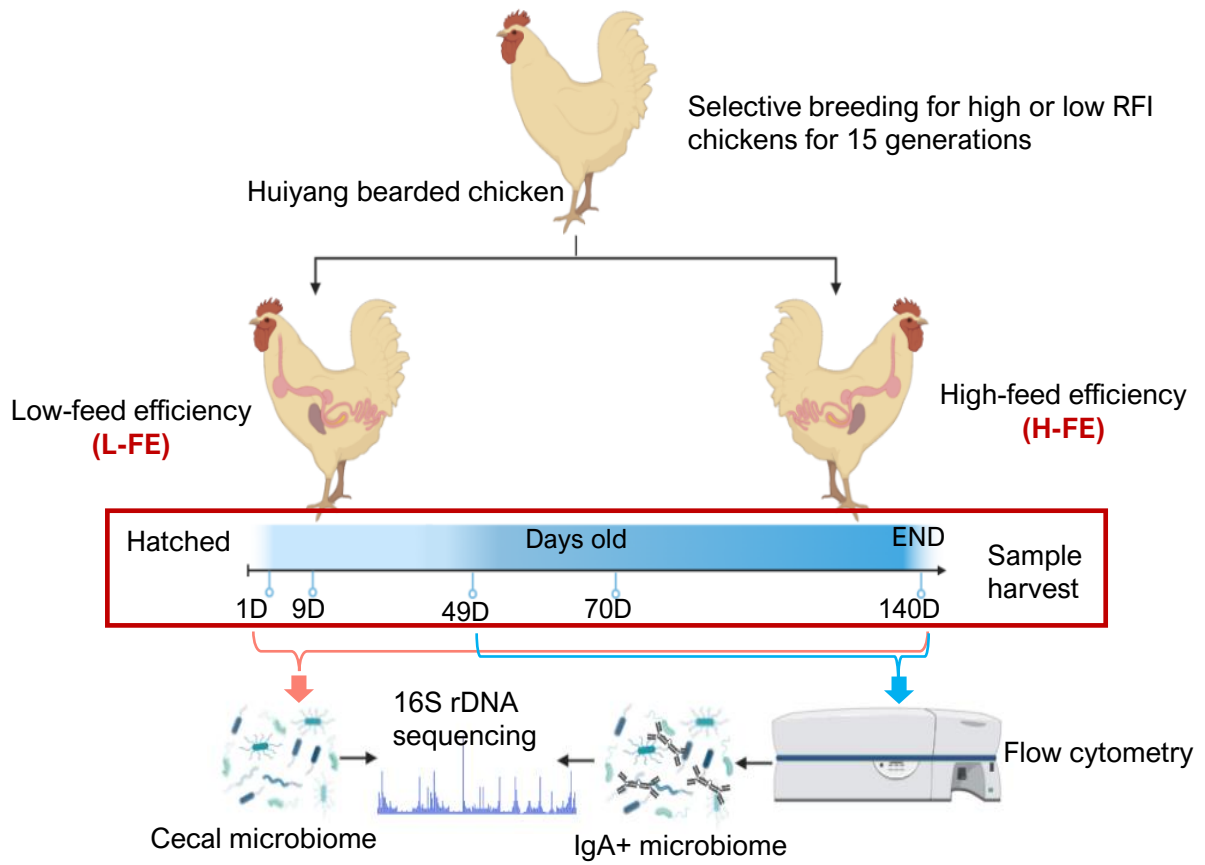
- **Gut microbiota**, as the host's second genome, plays a crucial role in nutrient utilization.
- **Immunoglobulin A (IgA)**, the most abundantly secreted antibody in the gut, not only maintains mucosal homeostasis and immune function but also regulates the composition of gut microbiota.

IgA-coated microbiome offers a new approach to identifying probiotics that influence feed efficiency in chickens



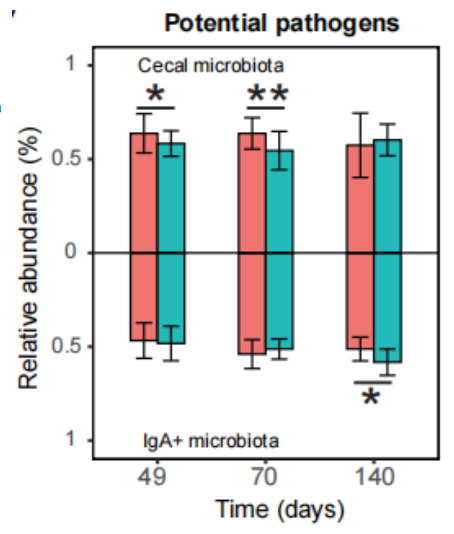
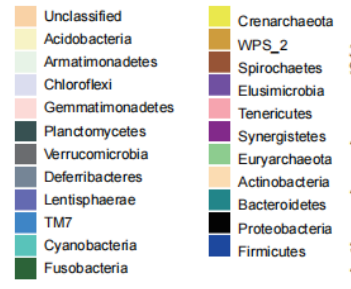
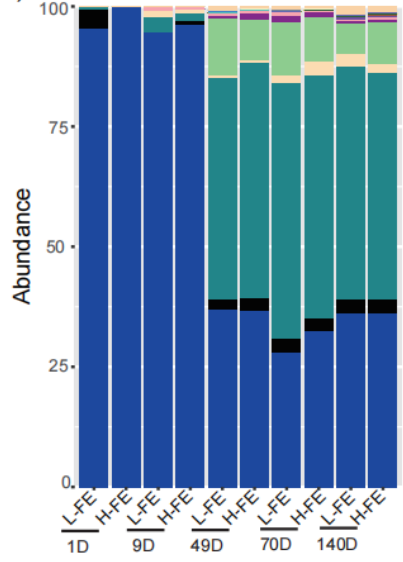
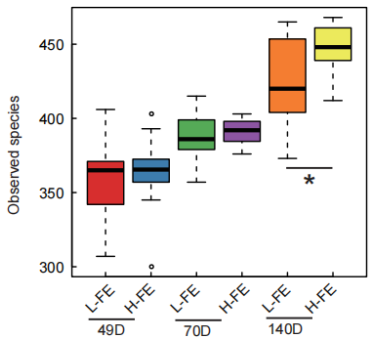
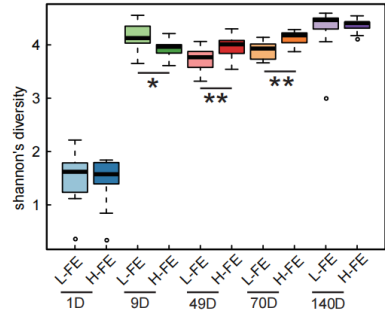


Experimental Model

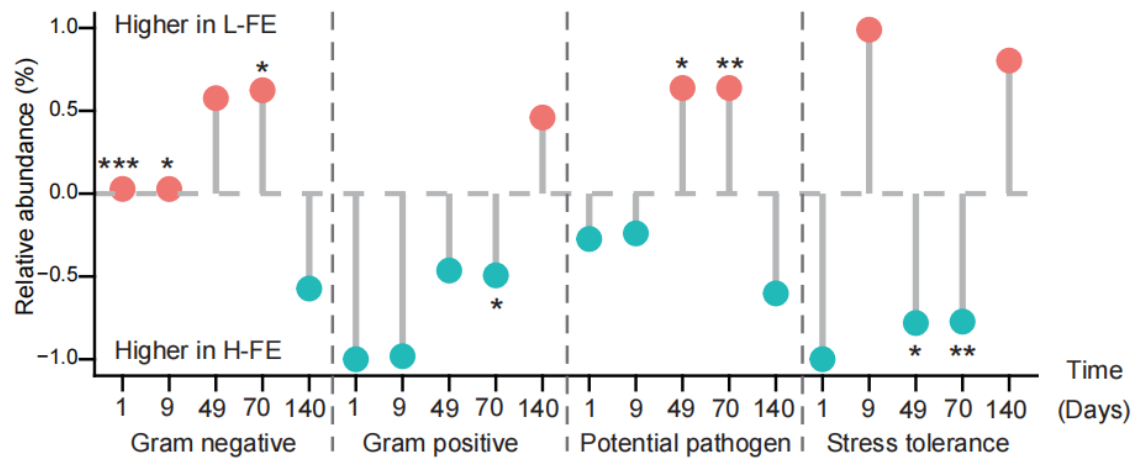


The feed efficiency (FE) between two chicken lines differs by **19.4%**, providing unique biological material for studying the impact of microbiota on feed efficiency

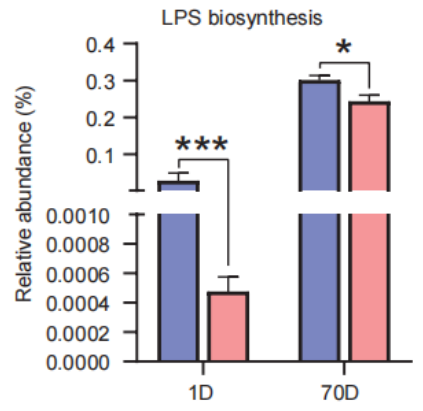
Cecal and IgA⁺ Microbiome Analysis Results



Bugbase analysis



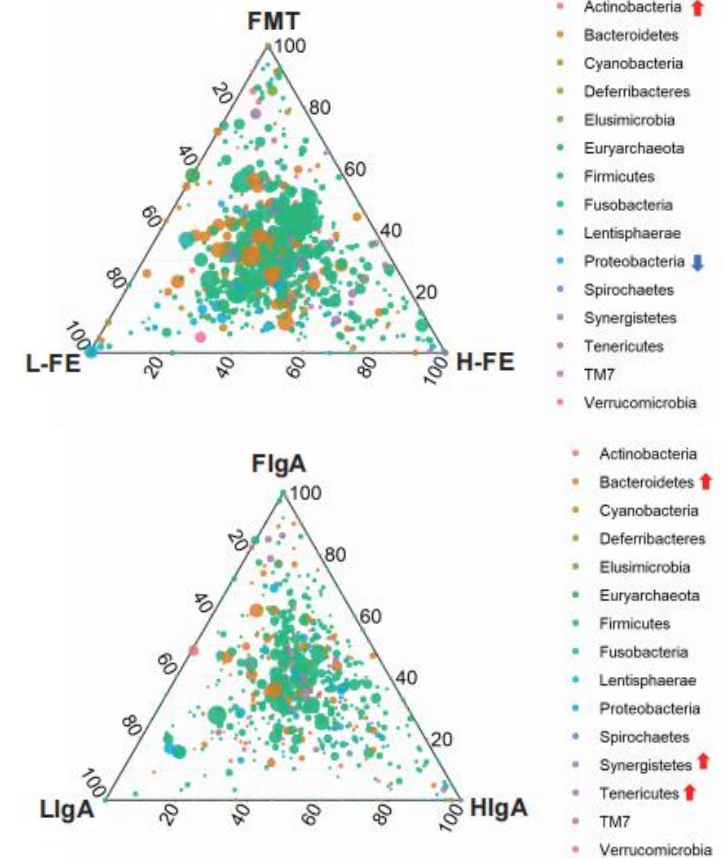
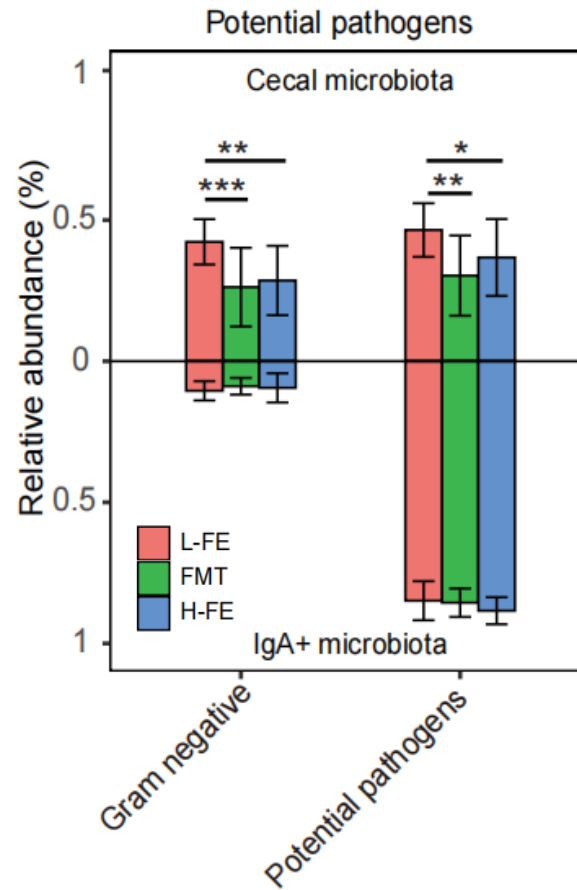
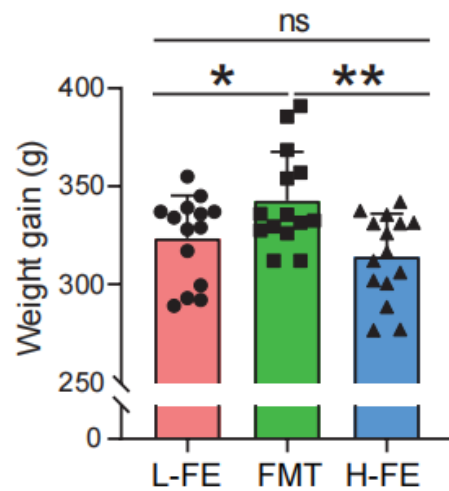
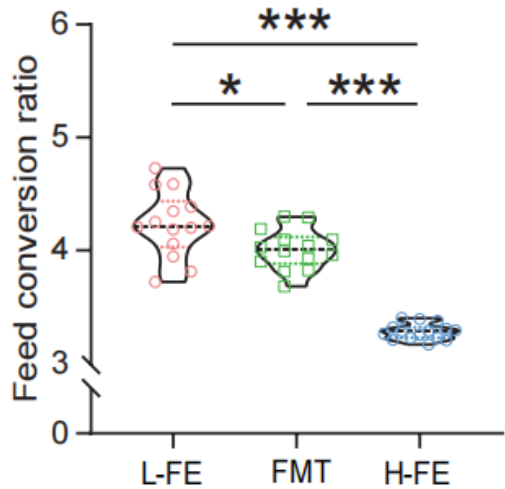
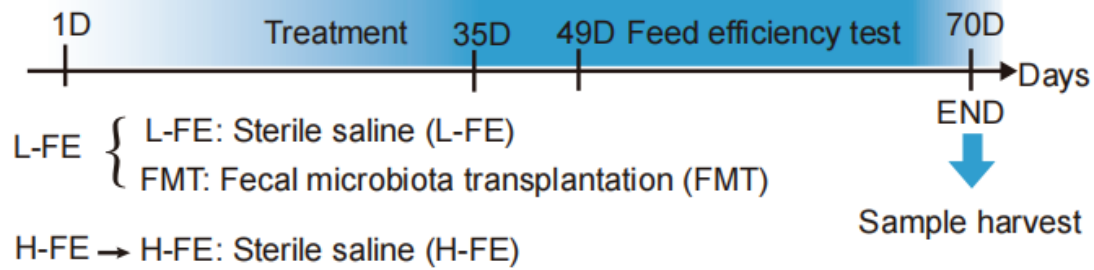
Legend for Bugbase analysis: L-FE (red), H-FE (blue)



- Significant differences in cecal and IgA⁺ microbiota between H-FE and L-FE chickens.
- **Firmicutes** dominate early (D1 and D9), while **Bacteroidetes** become dominant after 49 days.
- L-FE chickens have more **Gram-negative bacteria** and **potential pathogens**; H-FE chickens have more **Gram-positive** and **stress-tolerant bacteria**.
- No difference in potential pathogen abundance at D140, but IgA-bound pathogens are higher in H-FE, suggesting stronger IgA binding.
- LPS biosynthesis-related bacteria are more abundant in L-FE chickens.

Fecal microbiota transplantation (FMT)

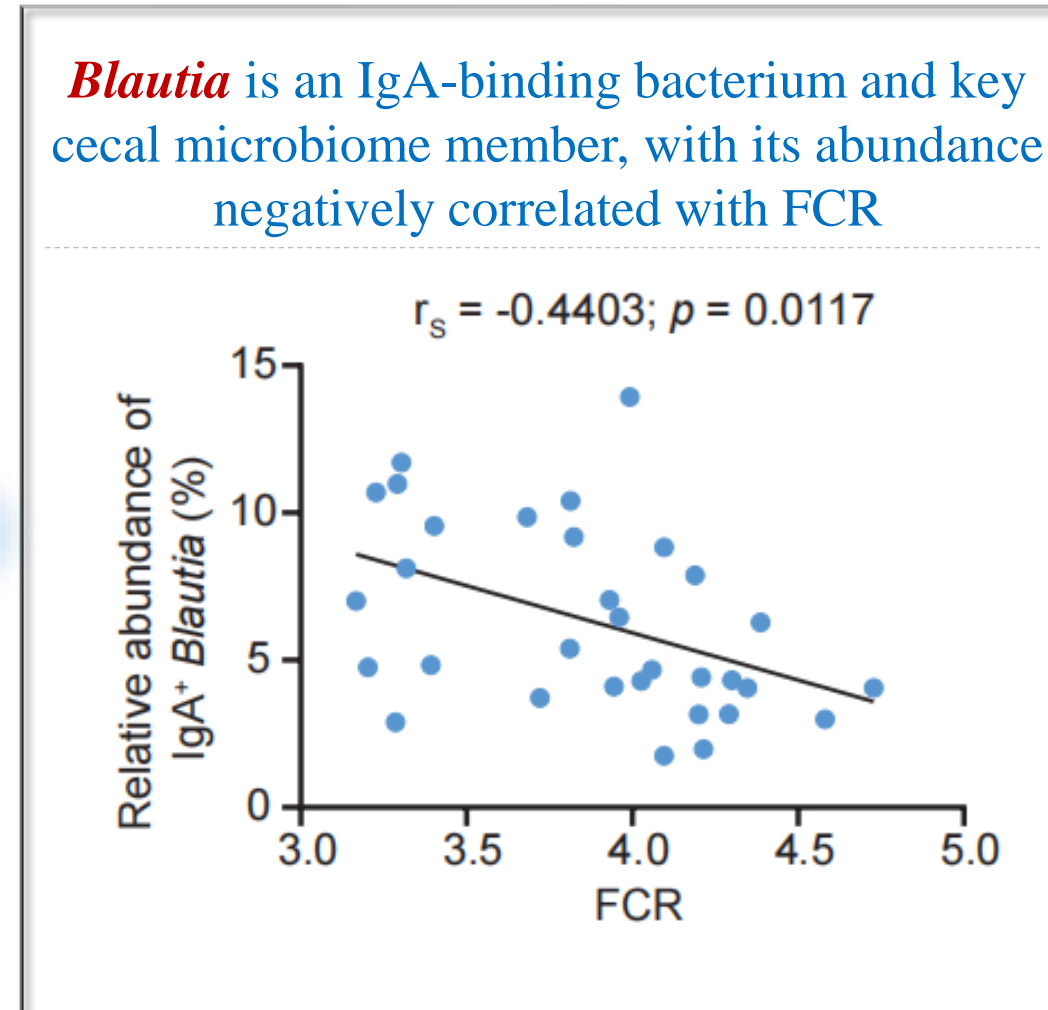
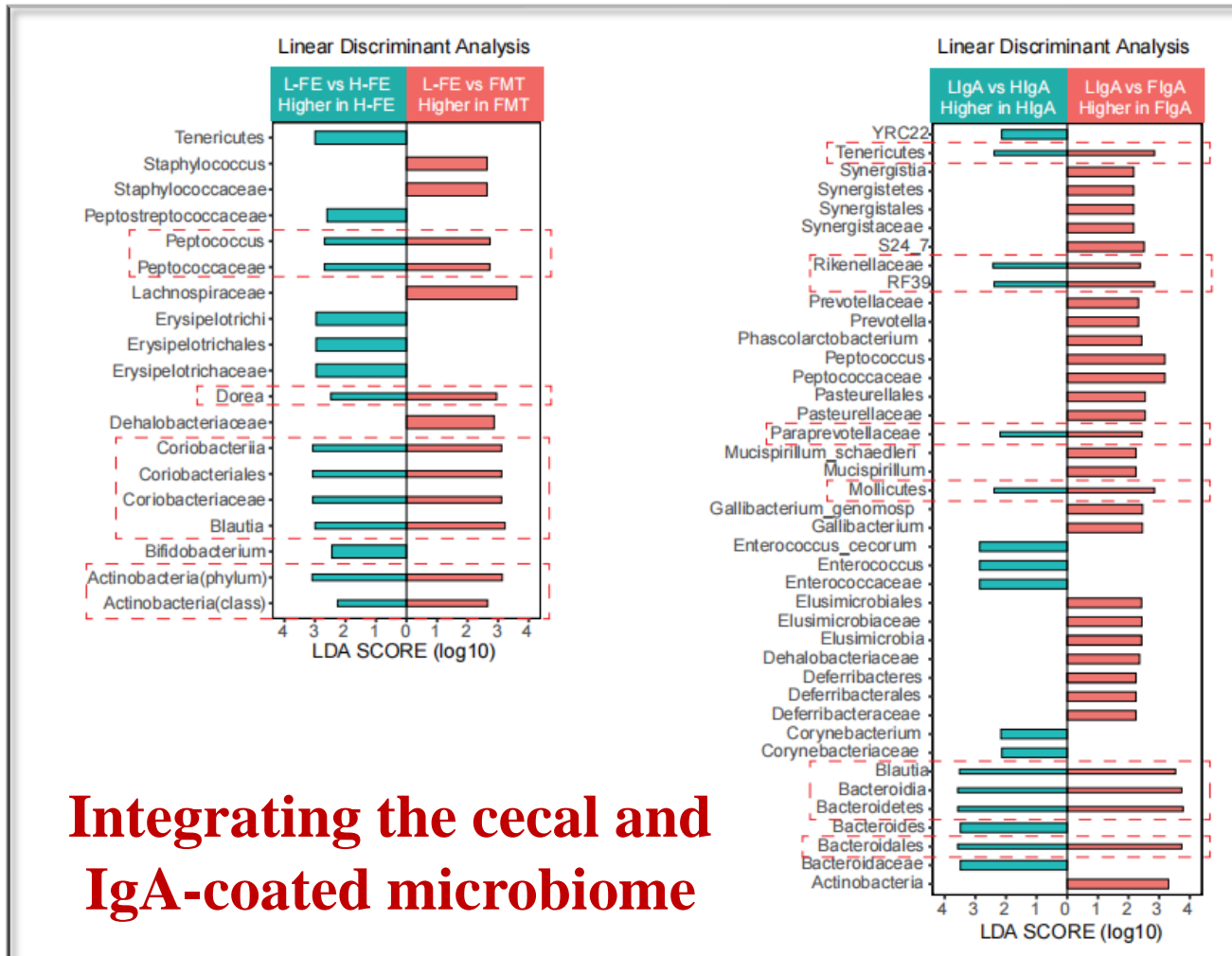
- FMT significantly improves FE in L-FE chickens, reducing **FCR from 4.23 to 4.01 (a 5% decrease)**.
- FMT also significantly lowers the relative abundance of **Gram-negative bacteria and potential pathogens** in the cecum of L-FE chickens.





Identification of Key Candidate Bacteria

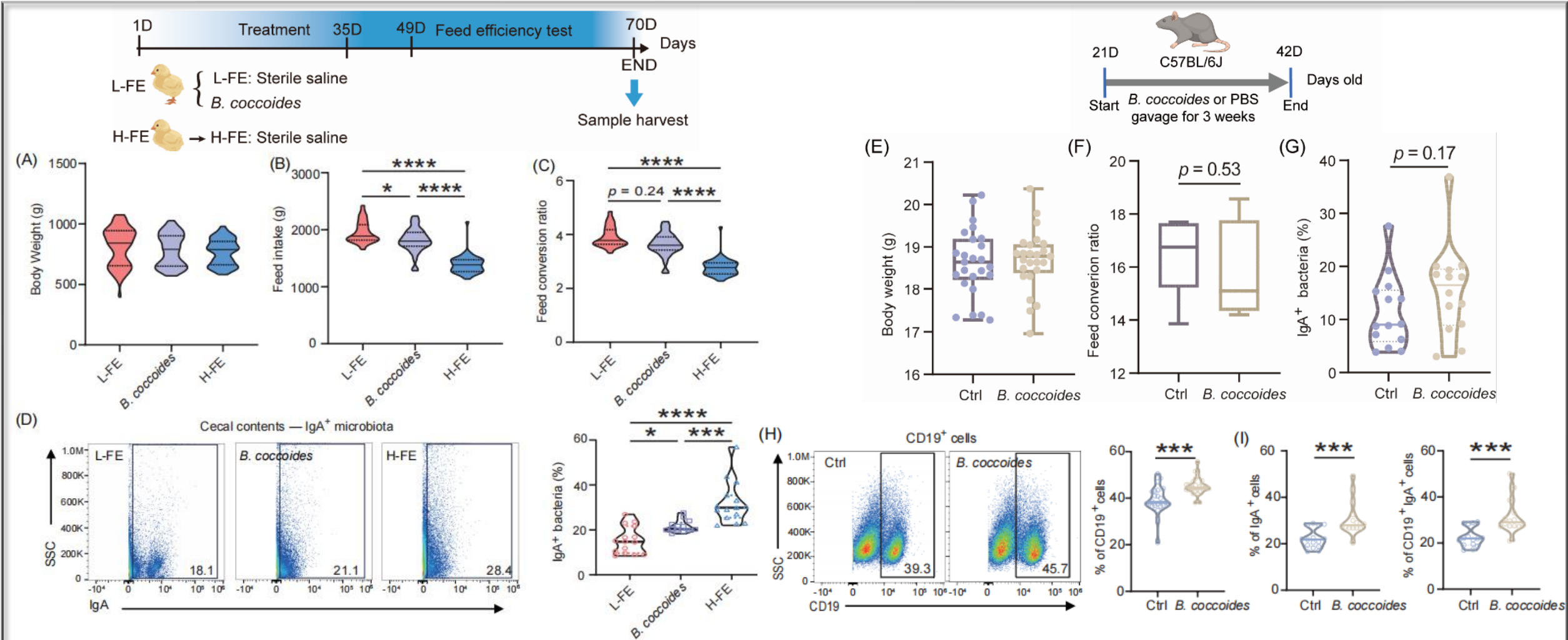
- By integrating the cecal and IgA⁺ microbiome, *Blautia* was identified as a key genus affecting feed efficiency, with its abundance negatively correlated with FCR.





Functional validation of IgA⁺ *Blautia*

- Through monobacterial gavage trials in chickens and mice, *Blautia coccoides* was preliminarily validated to improve feed efficiency and promote B cell activation into plasma cells.

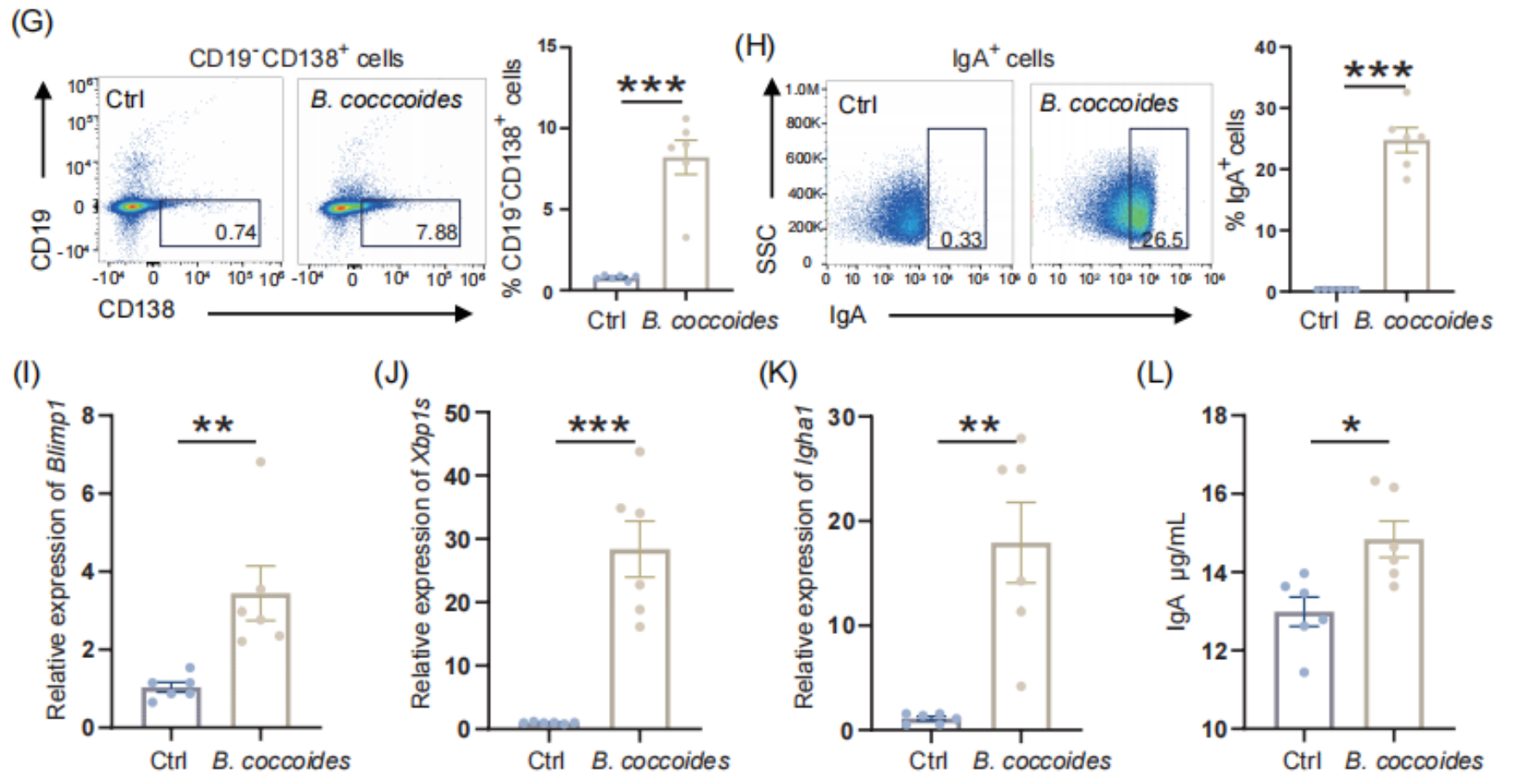
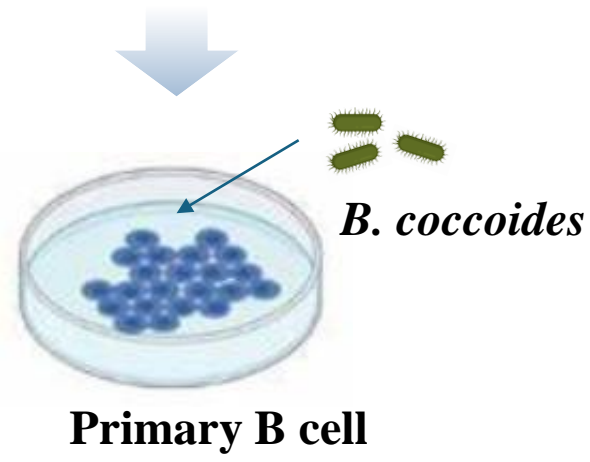




Mechanism exploration of IgA⁺ *Blautia*

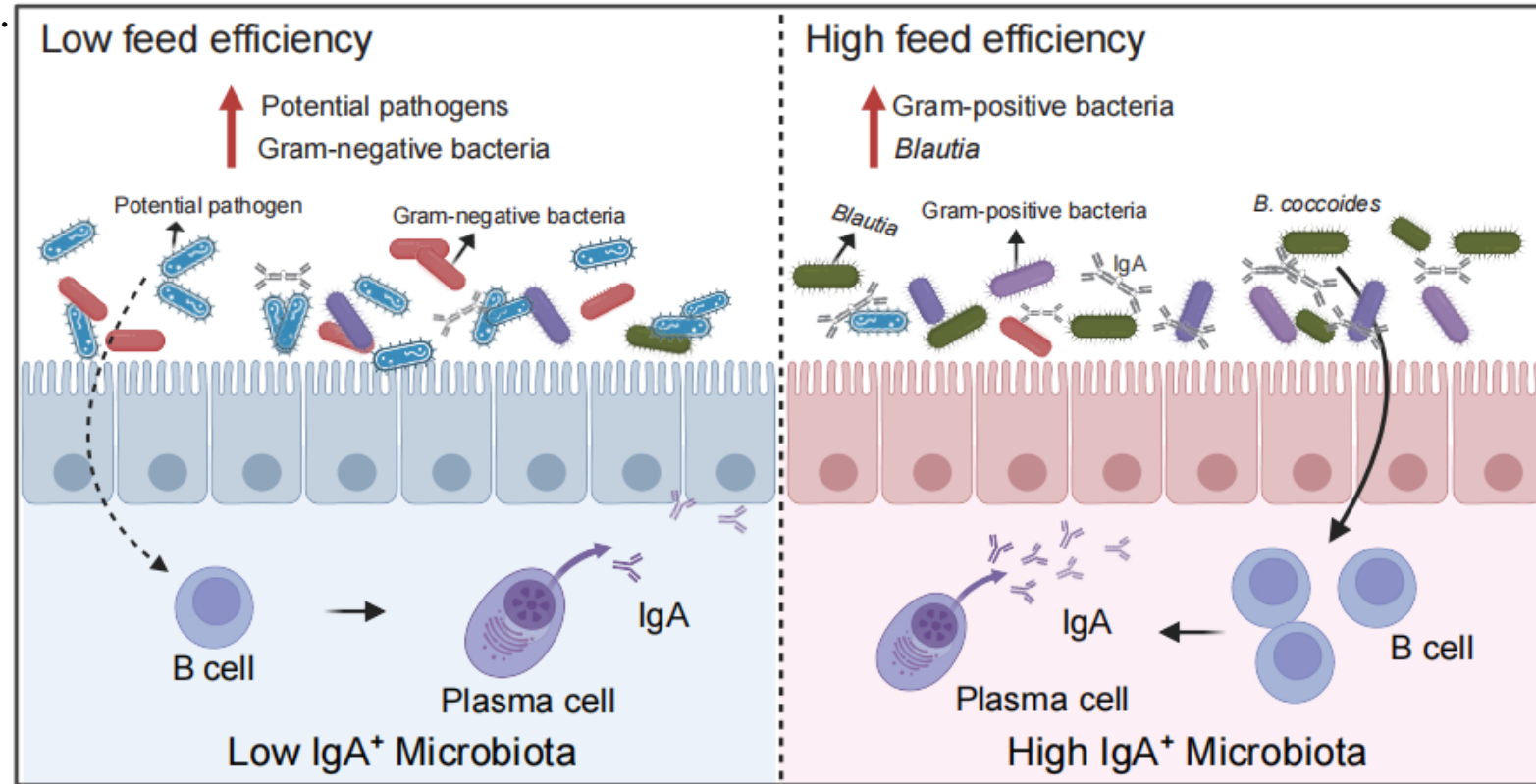
➤ *In vitro* co-culture of B cells with *B. coccoides* revealed that the bacterium effectively promotes B cell activation into IgA⁺ plasma cells, enhancing IgA secretion.

B cells co-culture with *B. coccoides*

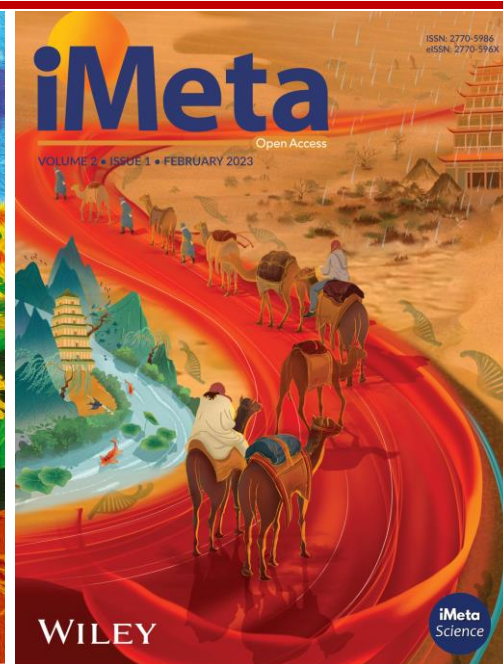


Summary

- Using high/low FE chicken populations, we compared cecal and IgA-binding microbiomes at different growth stages.
- FMT showed that gut microbiota can improve FE, and *Blautia* was identified as a potential probiotic.
- The effect of *Blautia* on improving FE was validated in chickens and mice, and its mechanism of activating B cells to secrete IgA was explored.



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