

Module 7: Immune Regulation & the Microbiome

How commensals educate the immune system — and what happens when they don't.

Tracks: Core, Clinical, Advanced | Duration: 60 min

KEY TAKEAWAYS

- The immune system and the microbiome co-evolved — immune tolerance requires microbial education.
- Loss of microbial diversity in industrialized populations parallels the rise of allergic and autoimmune disease.
- Gut bacteria can enhance or block cancer immunotherapy — this is one of the most actionable frontiers.

EVIDENCE-GRADED CLAIMS

Gut microbiome composition predicts response to anti-PD-1 immunotherapy	B — Supported, context-specific	Replicated in melanoma, NSCLC cohorts; specific taxa vary by study but pattern is consistent.
FMT from immunotherapy responders improves non-responder outcomes	C — Promising, preliminary	Small trials show signals; larger Phase II underway.
Reduced microbial diversity in childhood increases allergy risk	B — Supported, context-specific	Supported by birth cohort studies; hygiene hypothesis framework.
Specific probiotics prevent allergies in infants	C — Promising, preliminary	<i>L. rhamnosus</i> GG shows some benefit in high-risk infants; not generalizable to all probiotics.

CLINICAL CASE

Melanoma patient asking about FMT for immunotherapy

A 55-year-old with stage III melanoma on pembrolizumab (anti-PD-1) has had stable disease but no response at 12 weeks. He read about FMT improving immunotherapy response and asks whether he should pursue it, including abroad if not available locally.

How would you discuss the current evidence for microbiome-immunotherapy interactions, the risks of unregulated FMT, and the difference between clinical trial access and medical tourism?

SUMMARIES

For Patients

Your immune system learns what to attack and what to tolerate by interacting with gut bacteria from birth. When this education is disrupted — by too many antibiotics, overly sterile environments, or the wrong diet — it may contribute to allergies, autoimmune diseases, and even affect how well cancer treatments work.

For Clinicians

Commensal-immune crosstalk is mediated by antigen presentation in Peyer's patches, SCFA signaling (butyrate → Treg differentiation), and direct epithelial immune sensing (TLRs, NLRs). SFB induce Th17 in the small intestine (important for mucosal defense but also autoimmunity). *Clostridium* clusters IV and XI_{Va} promote colonic Treg expansion. The cancer immunotherapy field has shown that *Akkermansia muciniphila*, *Faecalibacterium*, and *Bifidobacterium* abundance correlate with anti-PD-1 response — FMT from responders can convert non-responders in small trials.

REFERENCES

- Gut microbiome modulates response to anti-PD-1 immunotherapy in melanoma patients — Gopalakrishnan V et al., Science 2018 [\[Link\]](#)