



Mucin-mediated adhesion determines priority effects in gut microbiome assembly

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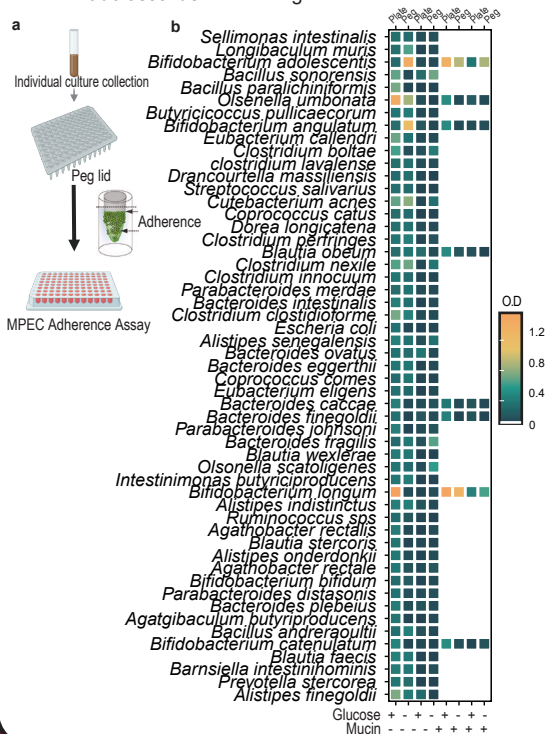
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Microbiome, Mucin and Priority effect

The gut microbiome develops through complex interactions, where early colonizers shape long-term community structure by influencing which microbes arrive and thrive later. The role of the mucin-rich environment as a key niche for microbial colonization is less understood. This study highlights how mucin adhering species guide microbiome assembly and ultimately impact host health

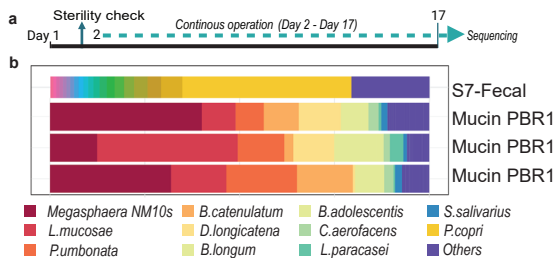
Mucin acts as a selective barrier

- First large-scale screen of 102 gut isolates, representing ~70% of gut functional potential, showed 53 species adhered in the presence of glucose.
- Out of these 53, only 8 species showed mucin adherence, with *Bifidobacterium longum* and *B. adolescentis* dominating.



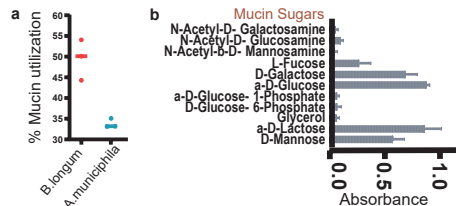
Individual mucin adherence property increases colonization success

- Packed column bioreactor shows mucosal communities diverged from fecal sample with mucin-adhering species driving stable and distinct microbiome assembly



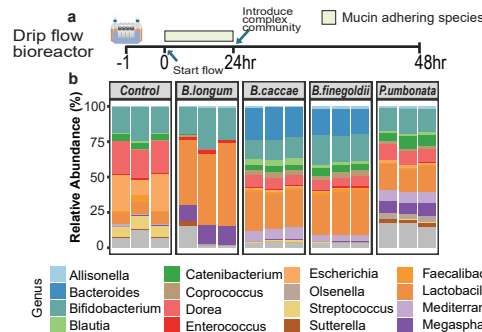
Preferential sugar utilization by *B. longum*

- *B. longum* preferentially utilized diverse mucin derived sugars, confirming its superior adaptation to mucosal niche

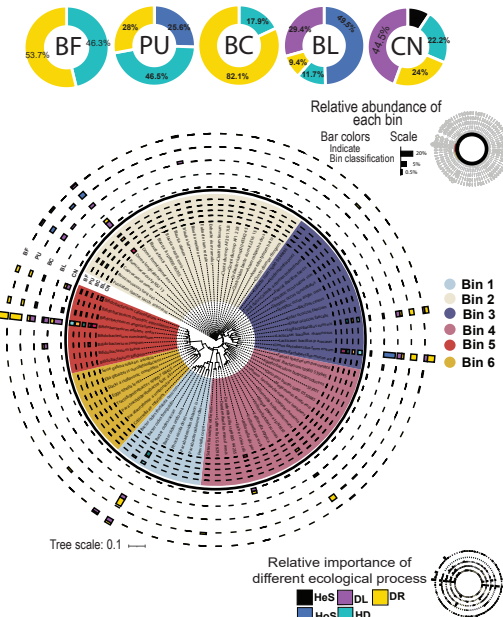


Mucin adherence drives colonization success through priority effects

- Each mucin-adherent pioneer directed the microbial community toward its own niche



Relative importance of different ecological processes in response to different early colonizers in mucin



- Early colonizer identity was a key determinant of microbial community assembly, with *B. longum* exerting the strongest effect.
- Mucin-adherent pioneers reproducibly shifted recruitment from random drift to structured, deterministic trajectories.

Conclusions

- Mucin shapes which microbes can colonize the gut
- Early mucin-adhering species set the stage for community assembly
- These first settlers influence long-term microbiome structure and host health

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