Capitalizing on gut health & fermented dairy foods

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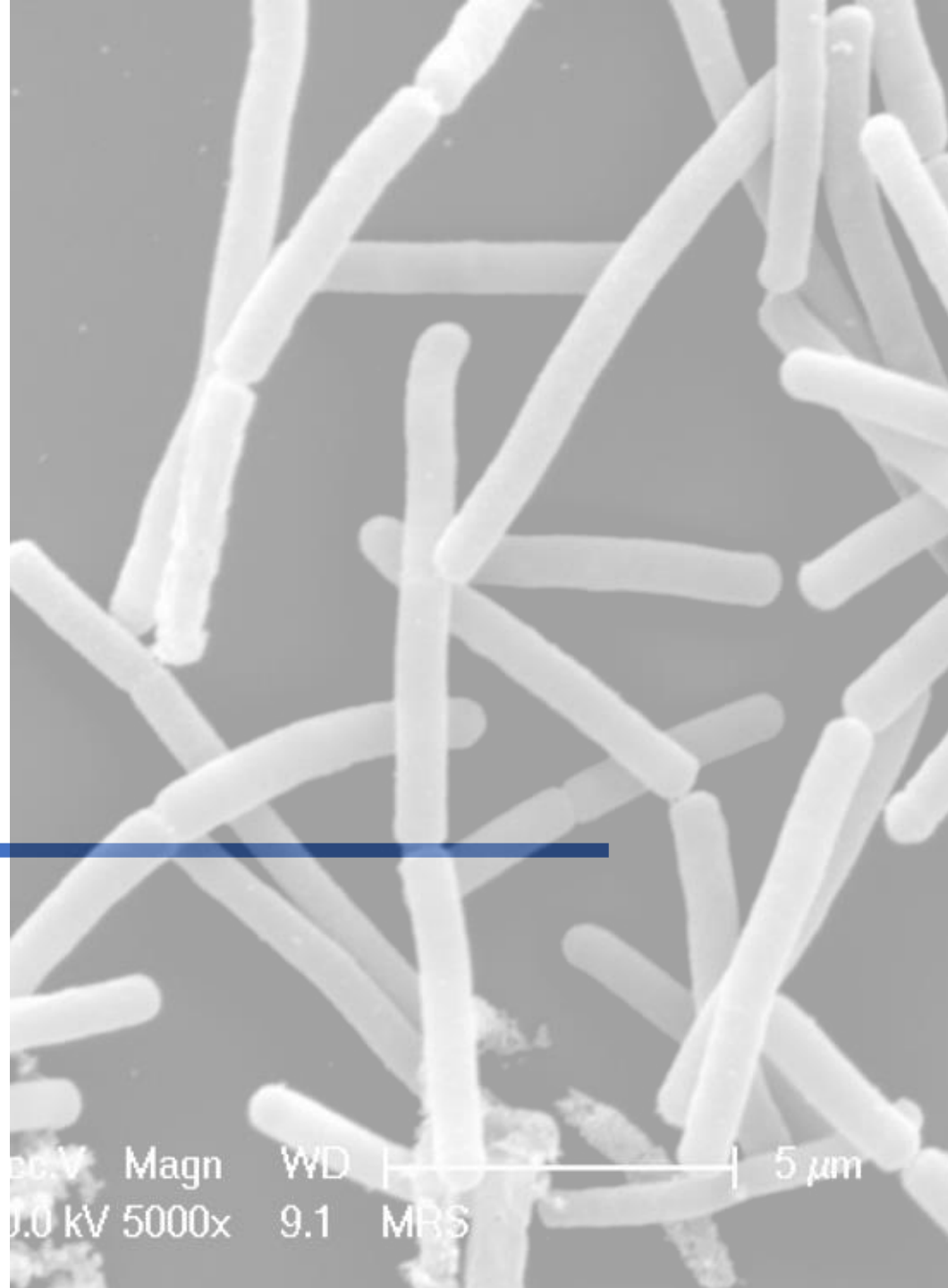
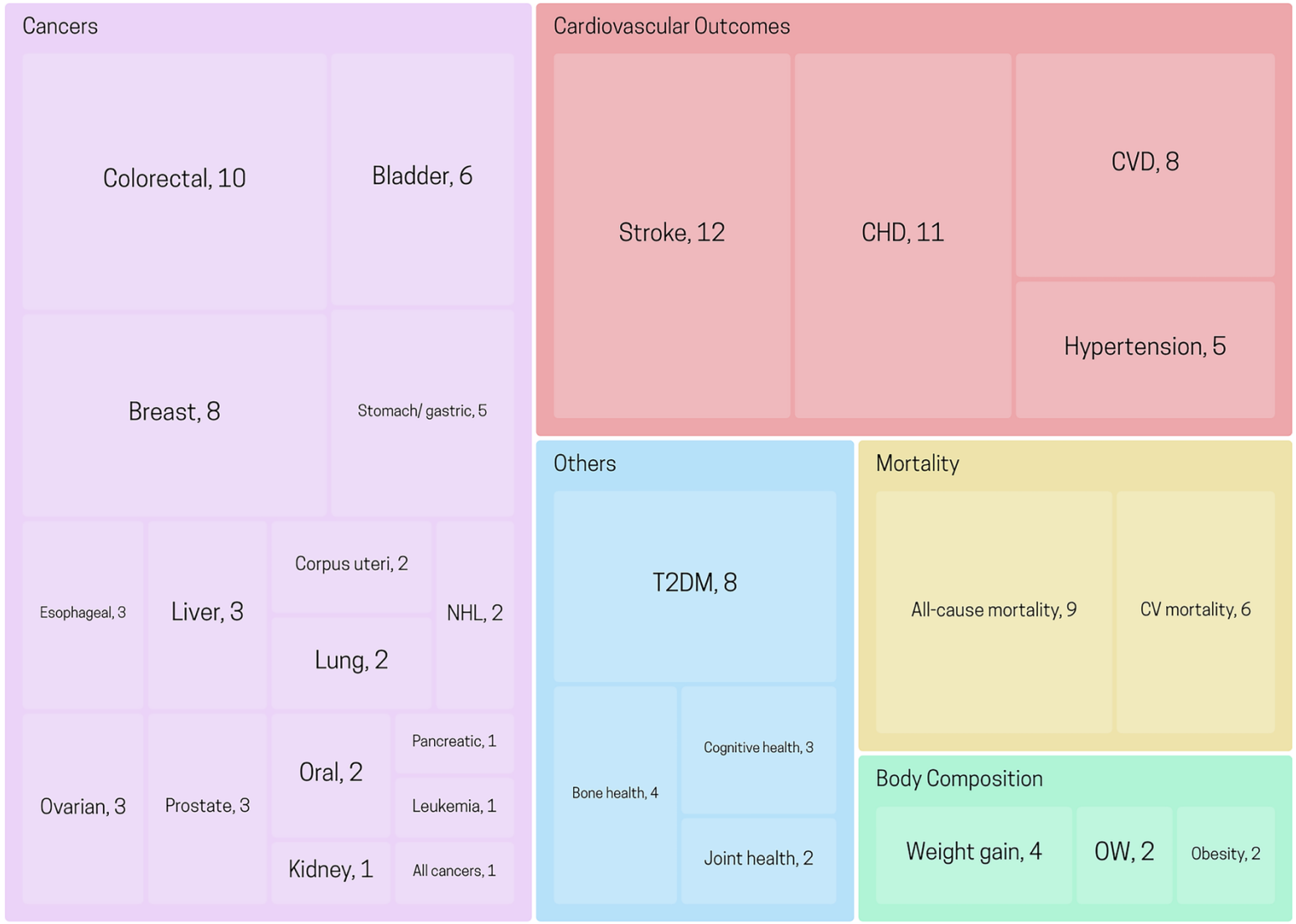
UCDAVIS
FOOD SCIENCE AND TECHNOLOGY



Milk & health



Number of included SR/MAs that report on each outcome. NHL, non-Hodgkin lymphoma; CHD, coronary heart disease; CVD cardiovascular disease; HBP, high blood pressure; T2DM, type 2 diabetes mellitus; CV, cardiovascular; OW, overweight.

281 associations identified:
38% : Reduced risk
48%: No association with risk
10%: Inconclusive
4.3%: Increased risk

“Evidence suggests that consuming dairy is not associated with an increased risk of non-communicable diseases or mortality. In fact, it may moderately reduce the risk of several health outcomes”

Akyil *et al* 2025 *Eur J Clin Nutr*

pollock communications
POWERING CHANGE
Food, Nutrition & Wellness Communications

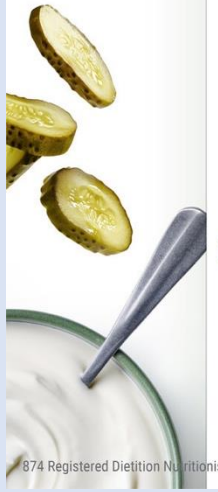
Today's Dietitian

THE 13TH ANNUAL WHAT'S TRENDING IN NUTRITION SURVEY

THE TOP 10 SUPERFOODS 2025

Trends come and go, but these superfoods stay!

1
FERMENTED FOODS
such as yogurt, pickles, kimchi, Kombucha Tea

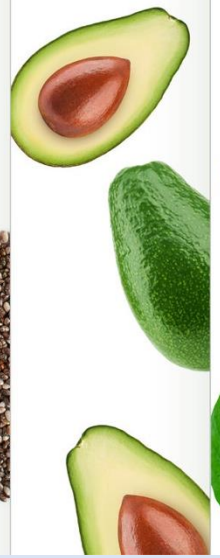


NEW 2
BERRIES
such as cranberries, blueberries, raspberries, etc.

NEW 3
BONE BROTH

4
SEEDS
such as chia and hemp

5
AVOCADO



NEW 6
LEAFY GREENS
such as kale and spinach

7
NUTS
such as almonds and walnuts

8
ANCIENT GRAINS

874 Registered Dietitian Nutritionists (RDNs) surveyed.

YOUR GUIDE TO A ealthy Gut

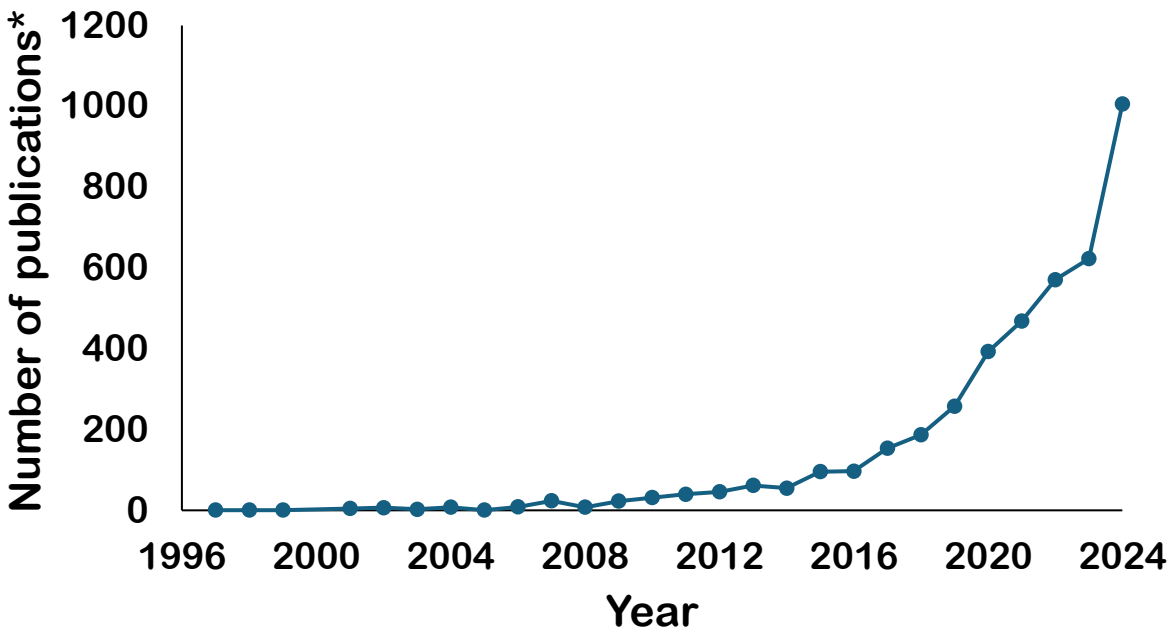
What Makes a Probiotic?

How Doctors Take Care of Their Gut

Mood-Boosting Meal Plans

gut health in scientific literature

- >4000 articles in PubMed that use the term
- ~700 with “gut health” in the title
- ~2000 published in the past three years alone



* “gut health” in title and/or abstract

What is gut health?

ISAPP
International Scientific Association for PROBIOTICS and PREBIOTICS

Non-profit scientific organization since 2002

Scientific leadership

Providing expert guidance and promoting rational, evidence-based approaches to biotic research and communication

Peer-reviewed publications and consensus guidance

Academic governance

Expert panels and working groups

Community building

Fostering a community of scientists and clinicians to build knowledge, connection and collaboration

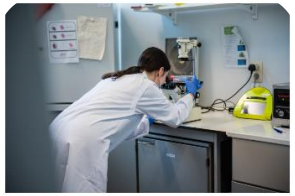
Scientific meetings

Early career development

Growing knowledge

Sharing evidence-based information with stakeholders and guiding appropriate implementation of biotic science

Educational resources



News and blog

Podcast

Gut health: what does it mean, can we measure it, and, if so, how?

ISAPP
International Scientific Association for PROBIOTICS and PREBIOTICS

London, UK. September 2024

Eamonn Quigley (co-chair): Gastroenterology
Maria L Marco (co-chair): Microbiology
Marla Cunningham: Biotics science

Stephan C. Bischoff: Gastroenterology
James D. Lewis: Gastroenterology
Daniel Merenstein: Family medicine
Hania Szajewska: Pediatrics
Heidi M. Staudacher: Nutrition and dietetics

Gerard Clarke: Gut-brain-microbiome axis
Nathalie Delzenne: Gut endocrine function
Marlies Meisel: Immunology
Paul W. O'Toole: Gut microbiology
Jerry M Wells: Intestinal cell biology

Gut health: what does it mean, can we measure it, and, if so, how?

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London, UK. September 2024

- State of the science – including current scientific usage, domains of gut health, metrics for assessment
- Affirm or propose revisions to the definition for optimal relevance and utility, and/or a conceptual framework for understanding the scope of gut health
- Clinical importance: determinants, modifiability, and application to health and disease prevention
- Identification of research gaps, stakeholders, and opportunities

nature reviews gastroenterology & hepatology

https://doi.org/10.1038/s41575-026-01176-x

Consensus statement

Check for updates

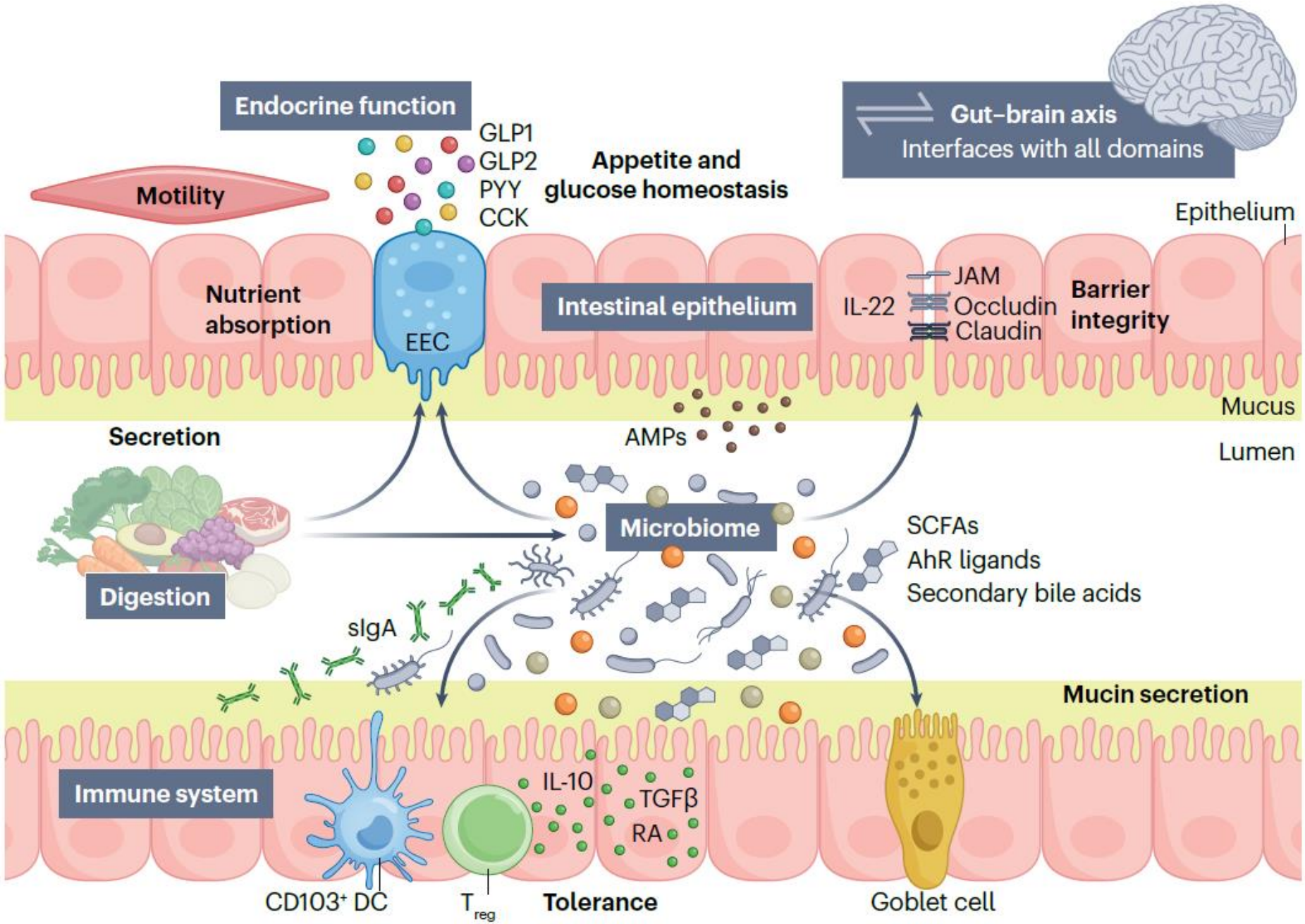
The International Scientific Association for Probiotics and Prebiotics (ISAPP) consensus statement on the definition and scope of gut health

Maria L. Marco[1] ✉, Marla Cunningham[2], Stephan C. Bischoff[3], Gerard Clarke[4], Nathalie Delzenne[5], James D. Lewis[6], Marlies Meisel[7], Daniel Merenstein[8], Paul W. O'Toole[9], Heidi M. Staudacher[10], Hania Szajewska[11], Jerry M. Wells[12] & Eamonn M. M. Quigley[13]

a state of normal gastrointestinal function without active gastrointestinal disease and gut-related symptoms that affect quality of life

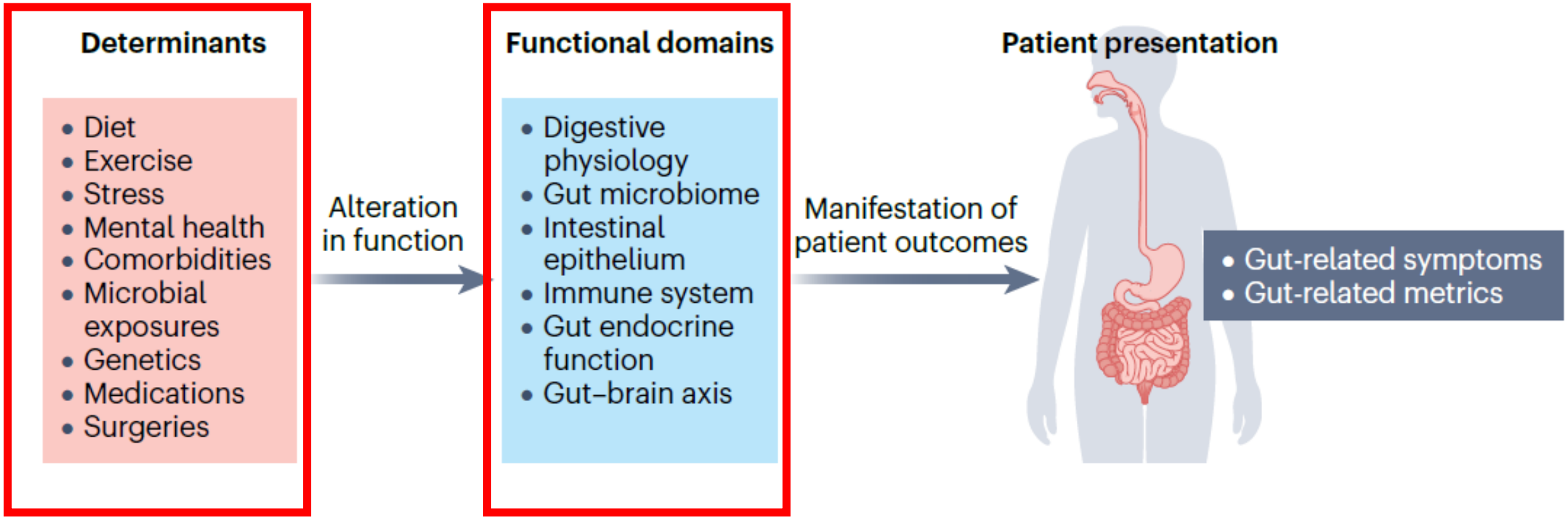
Published: 2/18/2026

Marco *et al* 2026 Nat Rev Gastroenterol Hepatol



Marco *et al* 2026 Nat Rev Gastroenterol Hepatol

Holistic approach to gut health



- Few validated metrics for assessing the functional domains.
- Risk factors for future gut health have yet to be determined.

Marco *et al* 2026 Nat Rev Gastroenterol Hepatol

Fermented dairy and gut health

- RCT and observational studies on fermented dairy with comparisons to milk, non-dairy controls, or no dairy consumption.

- Probiotic-fermented or probiotic-containing fermented dairy studies were included if on fermented dairy, not the probiotic.

- 37 human studies (mainly RCTs), including adults and children, with and without underlying conditions. (21 included probiotic strains).

Bui and Marco 2025 Nutr Rev

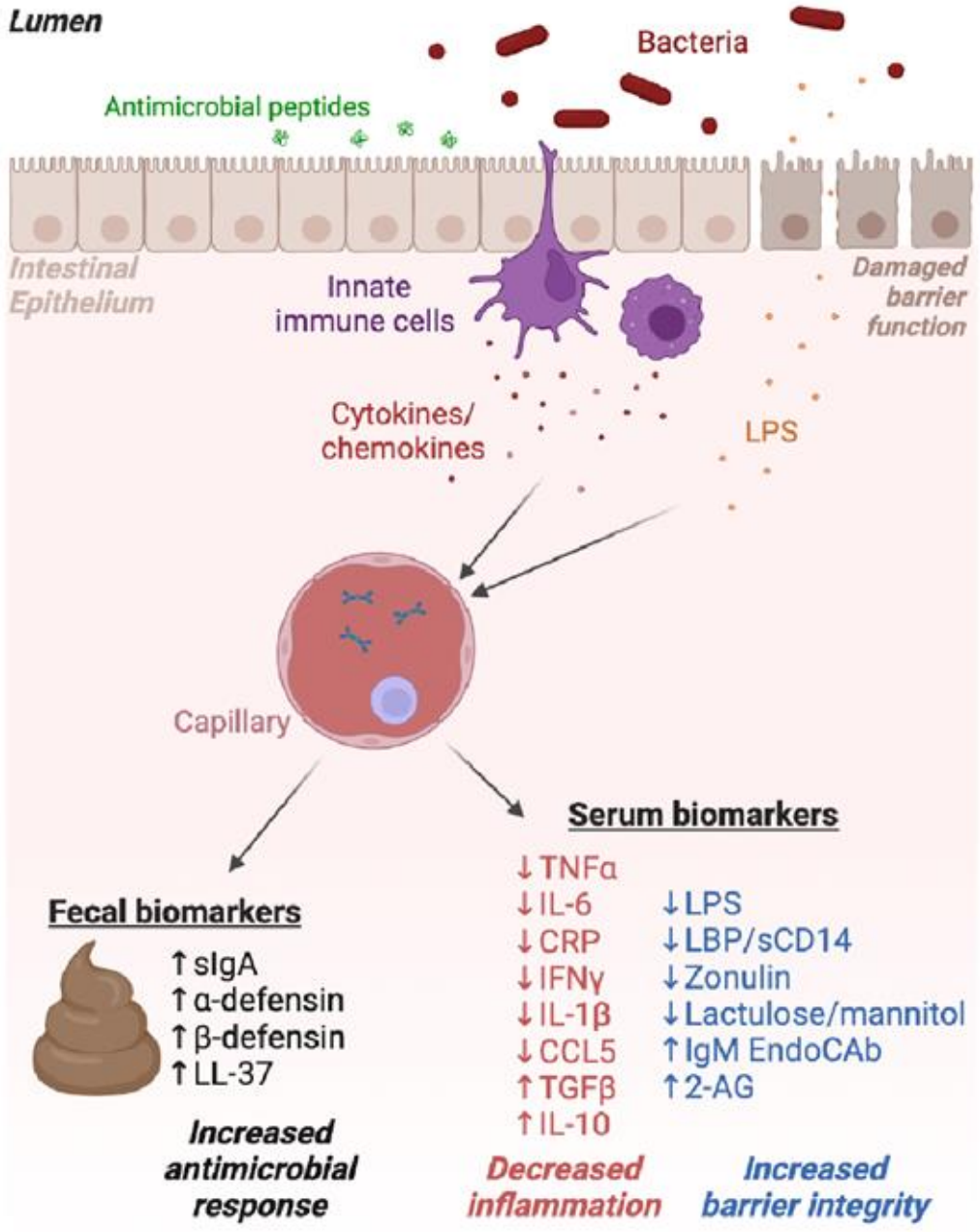
Fermented dairy and gut health

- No study reported a harmful effect
- 10 reported no benefit (symptom; immune)
- 27 with significant changes in one or more gut symptoms or gut health biomarkers
  (including 14 out of 20 studies measuring symptoms)

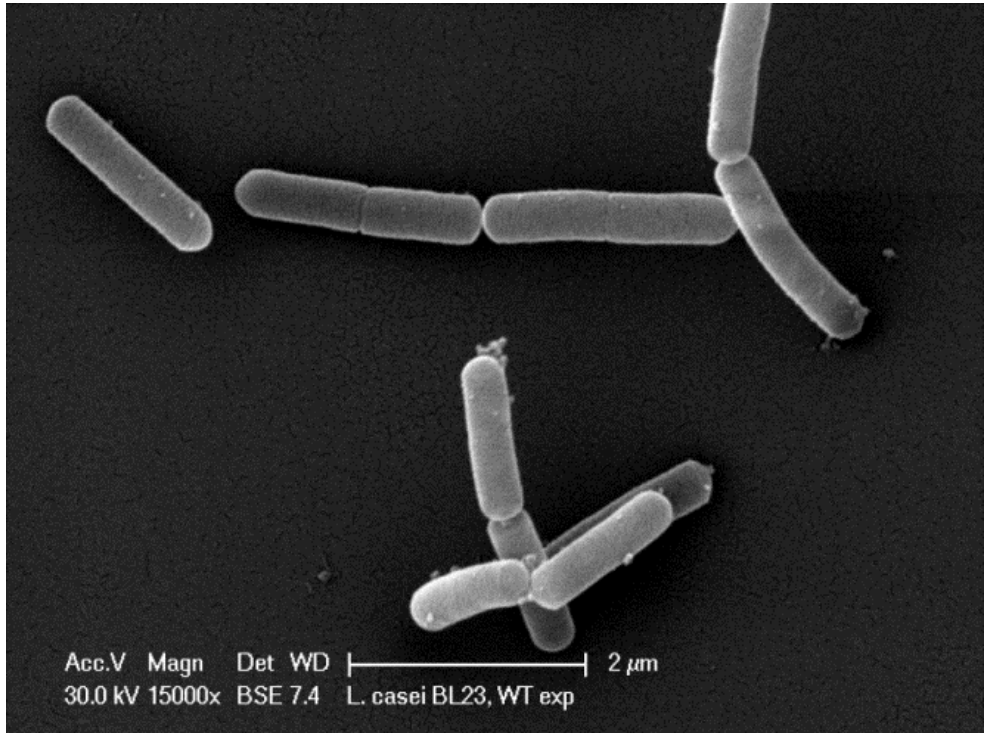
✓ Improved stool frequency and transit times

✓ Reduced abdominal and rectal symptoms

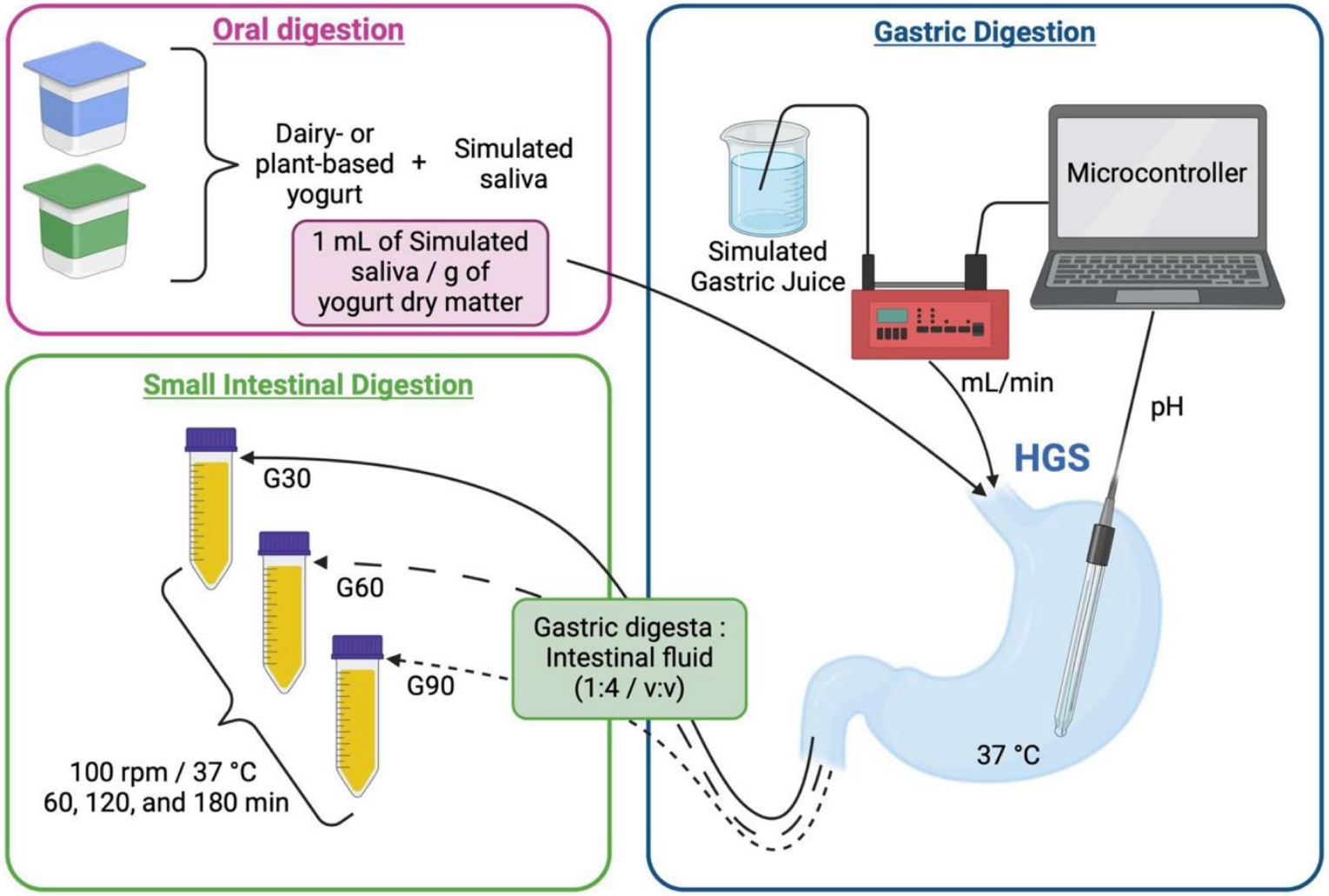
✓ Reductions in intestinal inflammation and serum TNFα levels (6 of 9 studies)



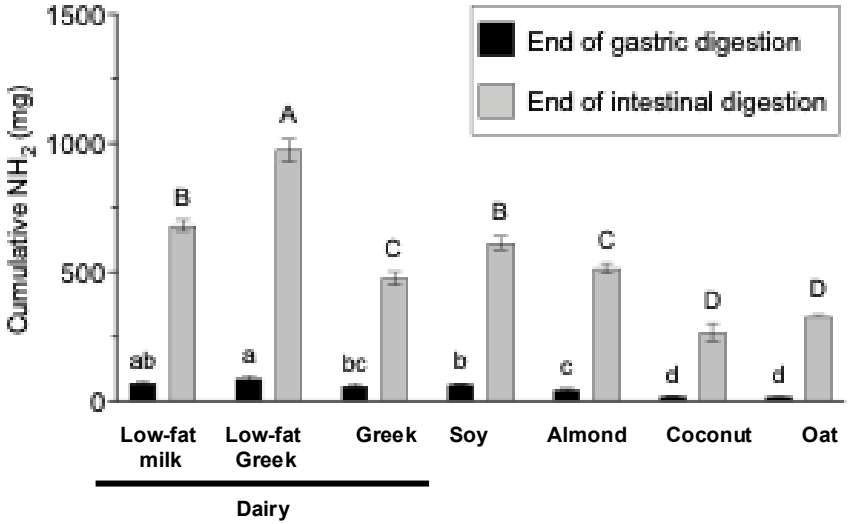
Bui and Marco 2025 Nutr Rev


Acc.V Magn Det WD 2 µm
30.0 kV 15000x BSE 7.4 L. casei BL23, WT exp

Do microbes in yogurt survive during digestion?



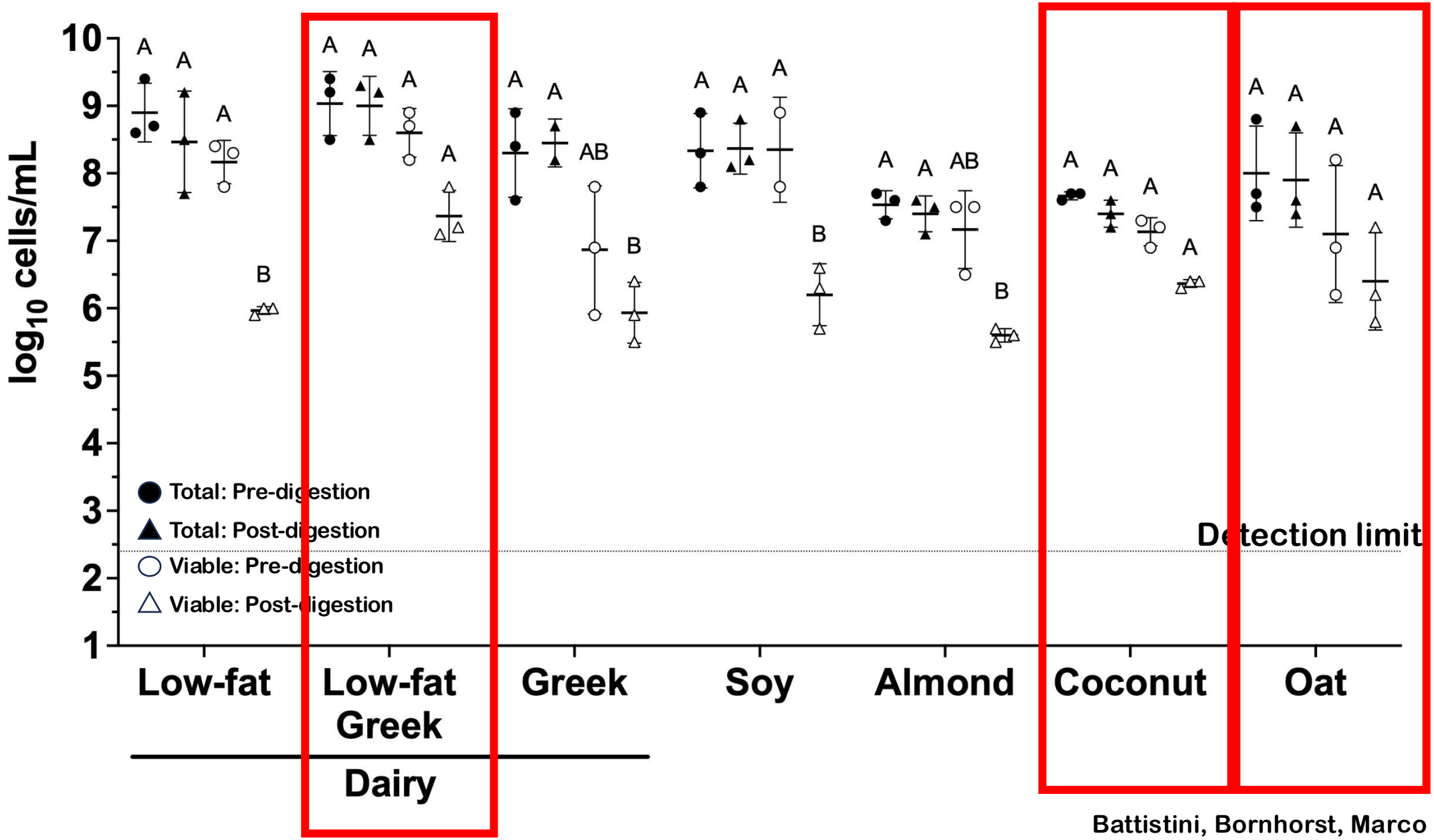
Free amino groups



mean ± SD (n=3); One-way ANOVA, Tukey-Kramer

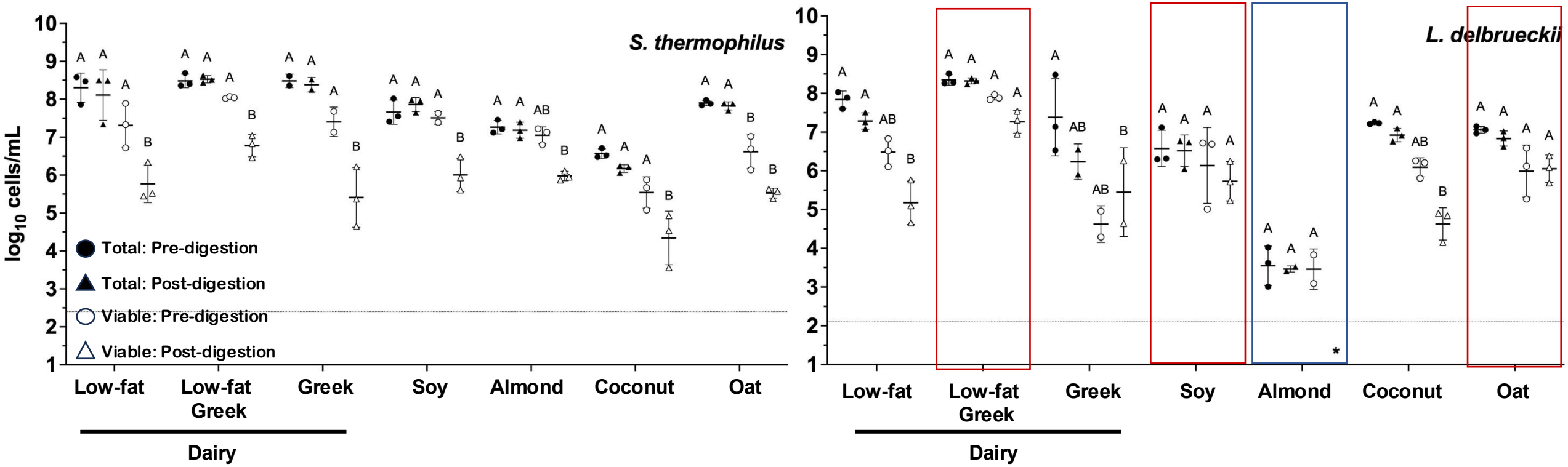
Battistini, Bornhorst, Marco *in preparation*

Total (living) bacteria in dairy and plant yogurt



Battistini, Bornhorst, Marco *unpublished*

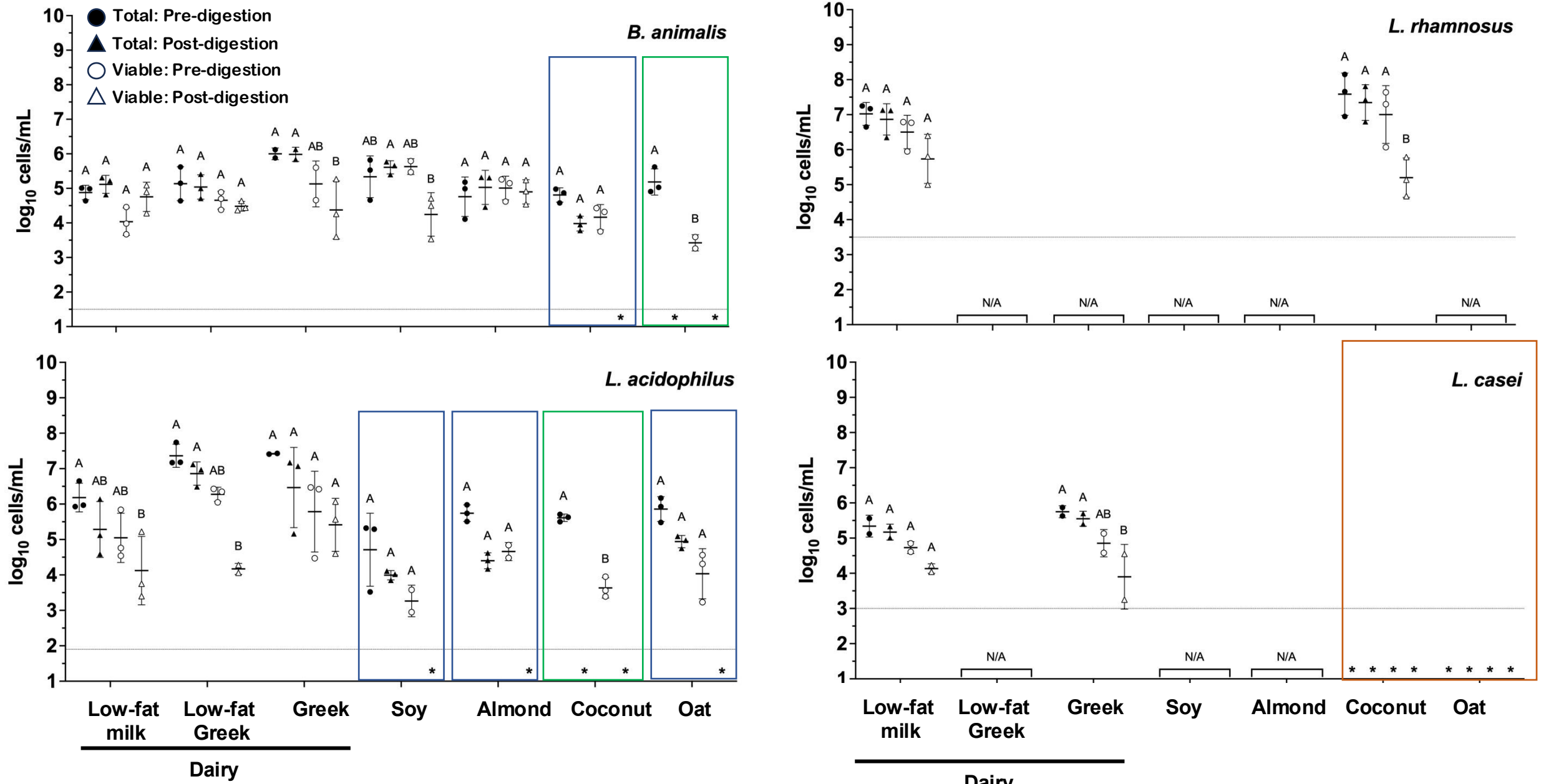
Yogurt bacteria survival during digestion is species and matrix dependent



Total: qPCR; Viable: PMA-qPCR

Battistini, Bornhorst, Marco *in preparation*

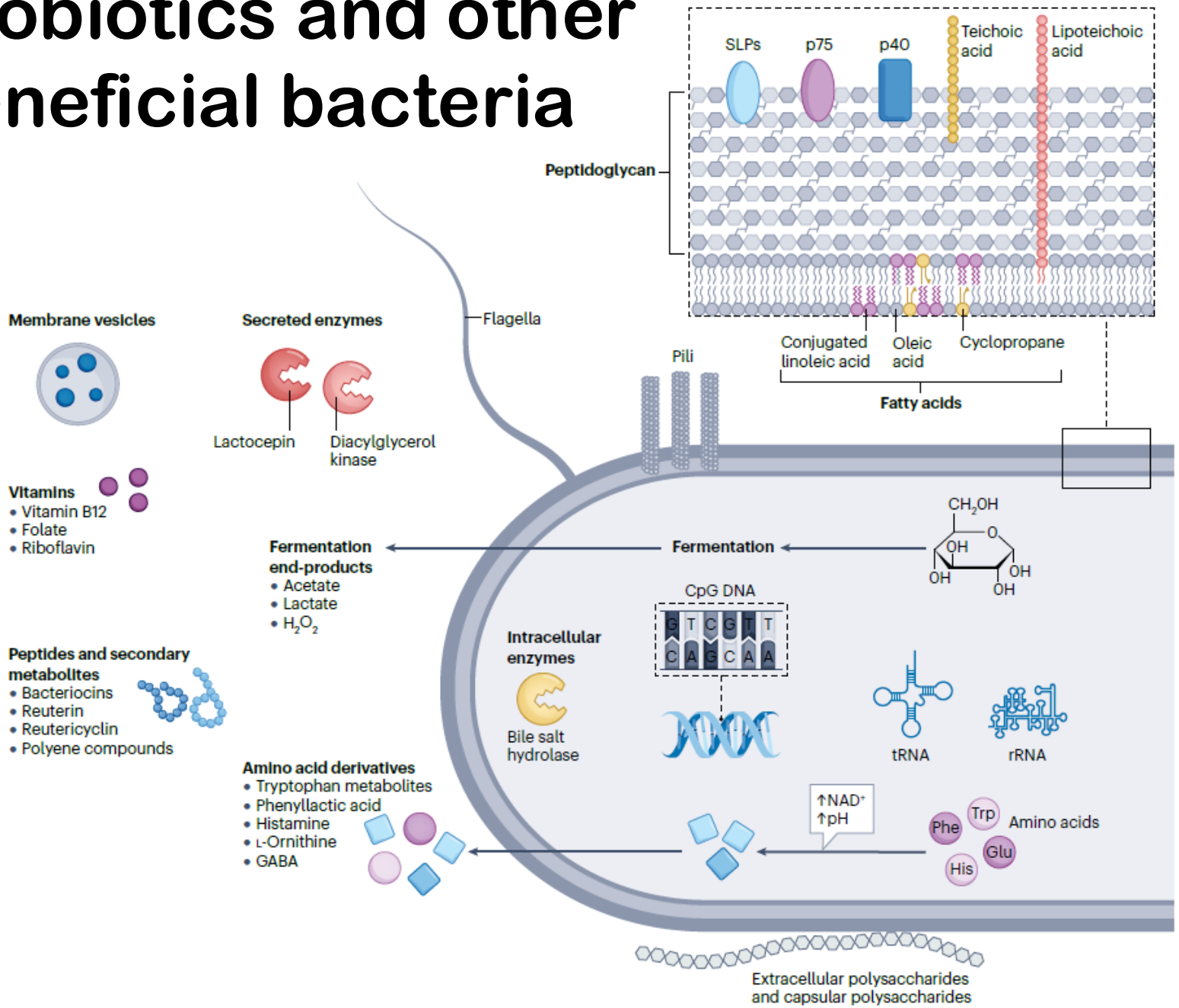
Dairy consistently provides viable microbes to the gut



Least Squares Means followed by Tukey–Kramer tests ($p < 0.05$).

Battistini, Bornhorst, Marco *in preparation*

Probiotics and other beneficial bacteria

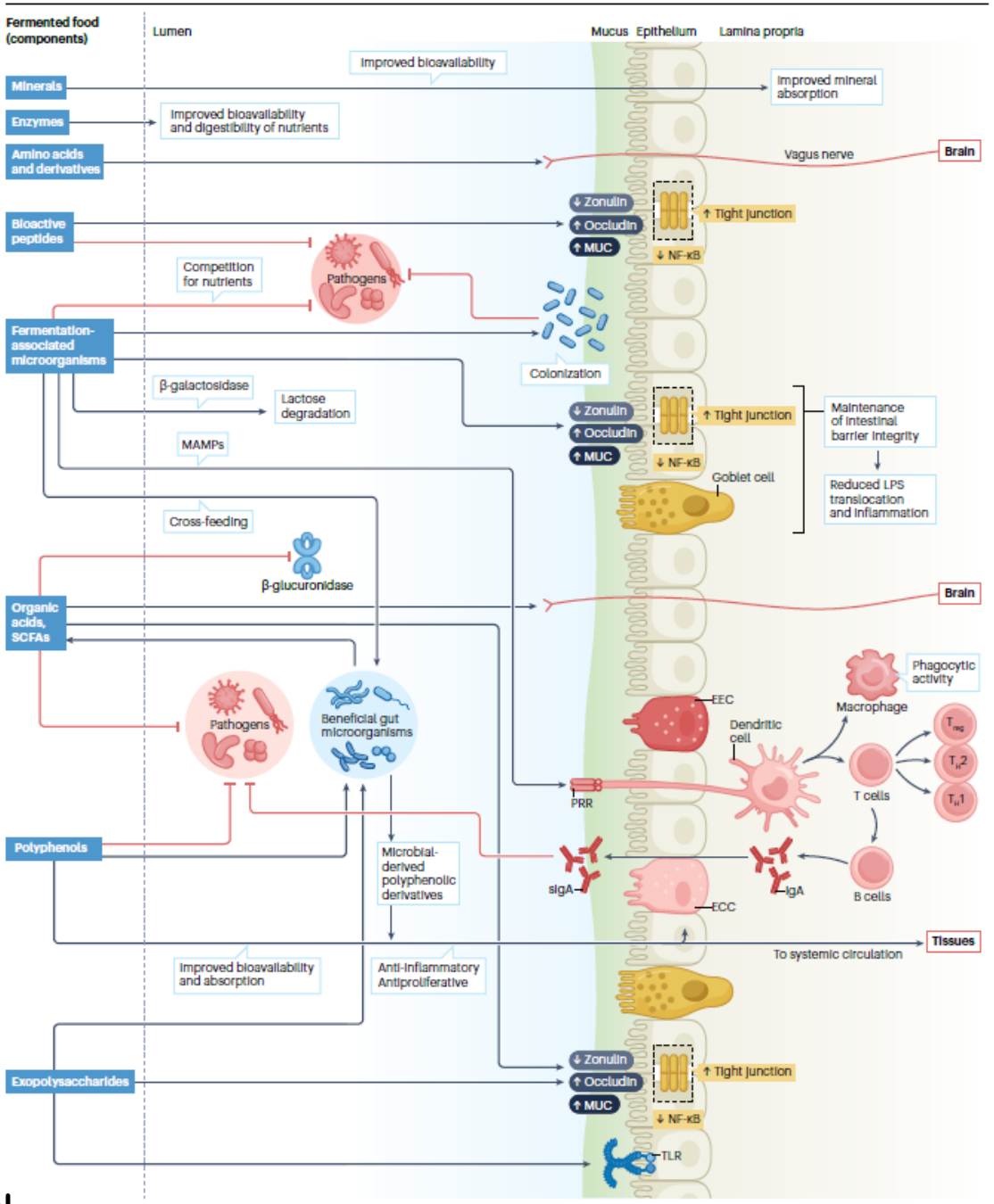


High amounts of beneficial microbes

- **Lactobacilli and other lactic acid bacteria are best understood to support health**
- **Health-modulatory compounds are known**

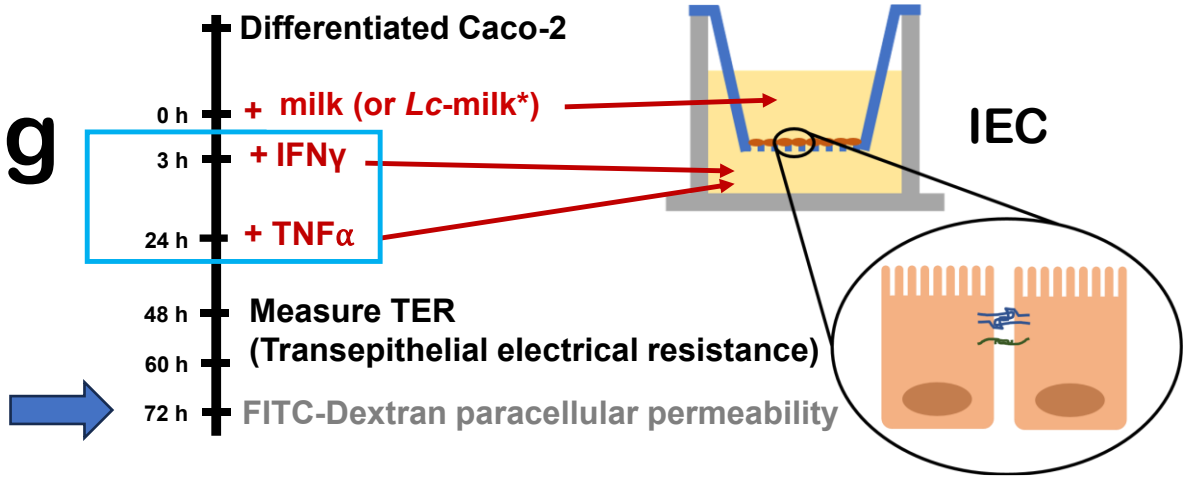
Alejandra Mejia Caballero & Marco 2025 Nat Rev Microbiol

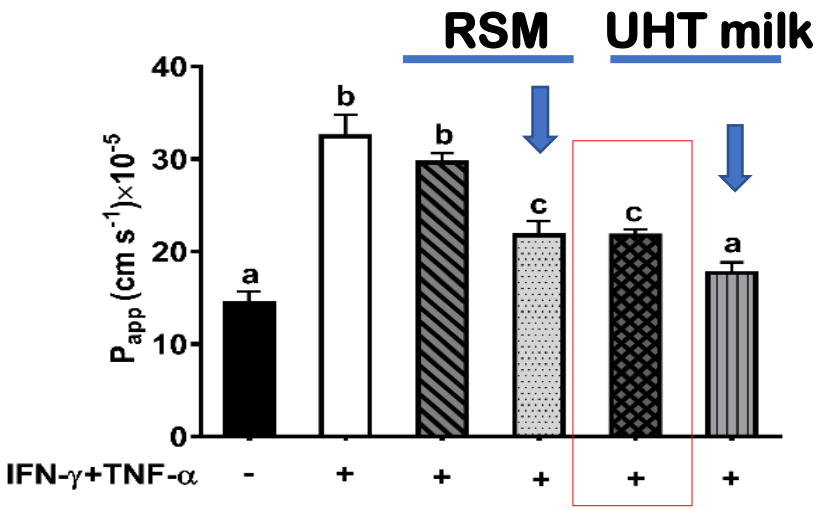
Metabolites and other compounds



Mukherjee, Dimidi, Marco, Cotter *et al* 2023 Nat Rev Gastroenterol Hepatol

L. paracasei fermented milk reduces IEC permeability during cytokine challenge

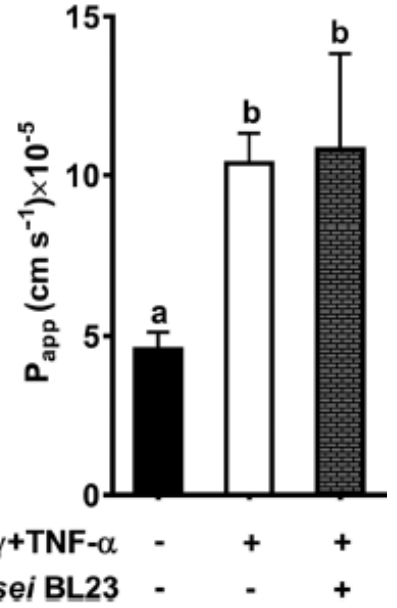




- 25% v/v Reconstituted skim milk (RSM)
- 25% v/v *L. paracasei* fermented RSM (FRSM)
- 25% v/v 2% Ultra-High Temperature (UHT) pasteurized milk
- 25% v/v *L. paracasei* fermented UHT milk (FUHT)

IEC: Intestinal epithelial cell
P_{app} : FITC-Dextran permeability
Cell-free filtrate of (fermented) milk was applied

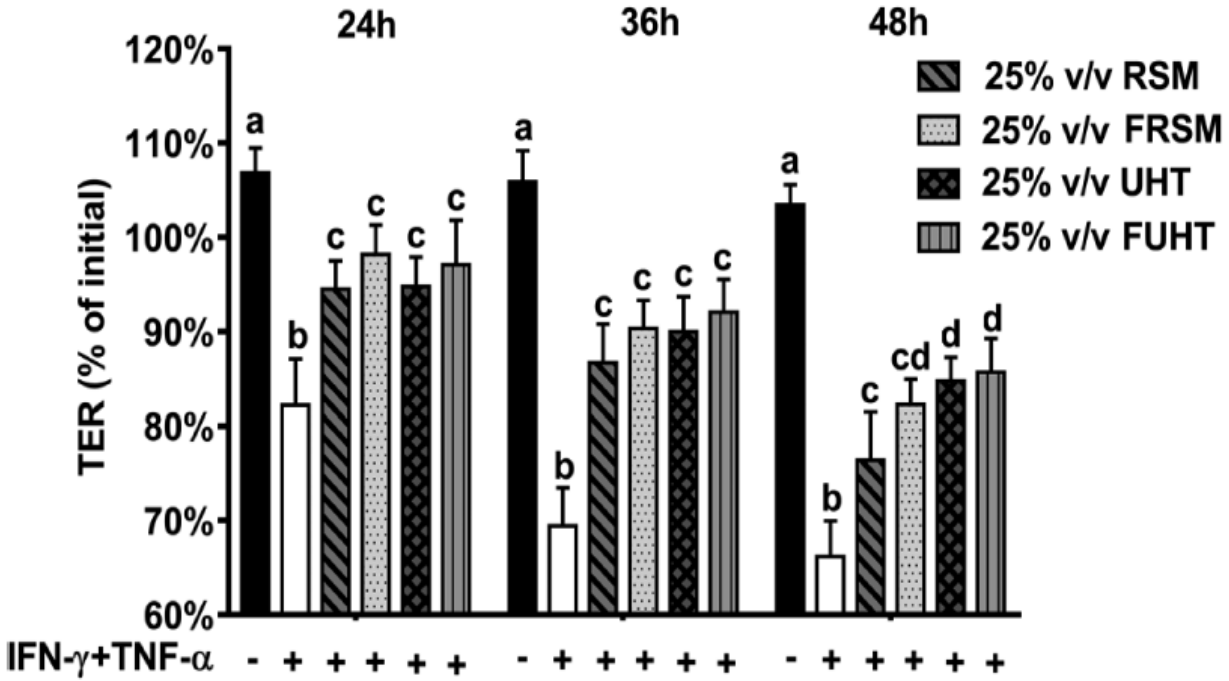
L. paracasei alone is ineffective

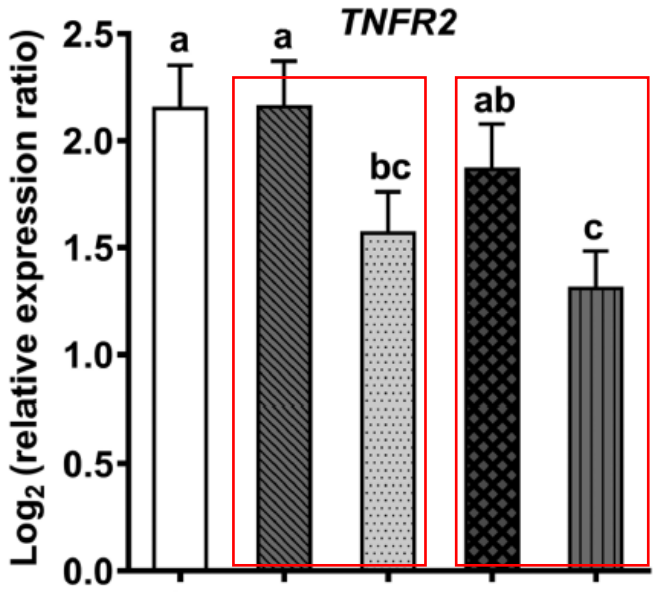


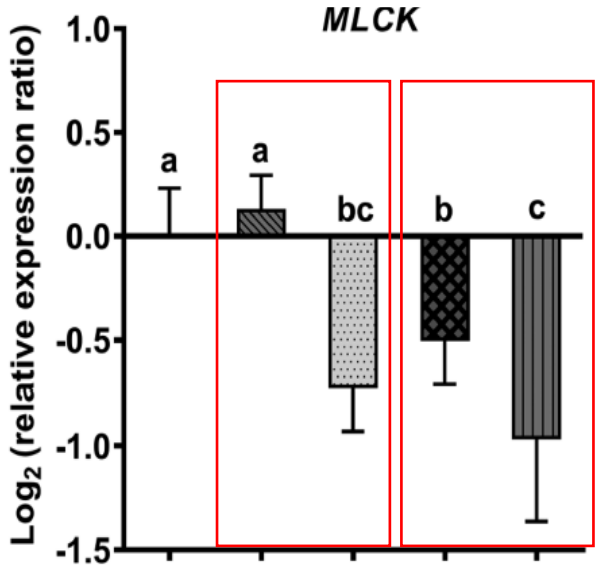
DMEM
(culture medium)

Zhai *et al* 2019 J Ag Food Sci

L. paracasei fermented milk preserves IEC barriers







25% v/v Reconstituted skim milk (RSM)

25% v/v *L. paracasei* fermented RSM (FRSM)

25% v/v 2% Ultra-High Temperature (UHT) pasteurized mil

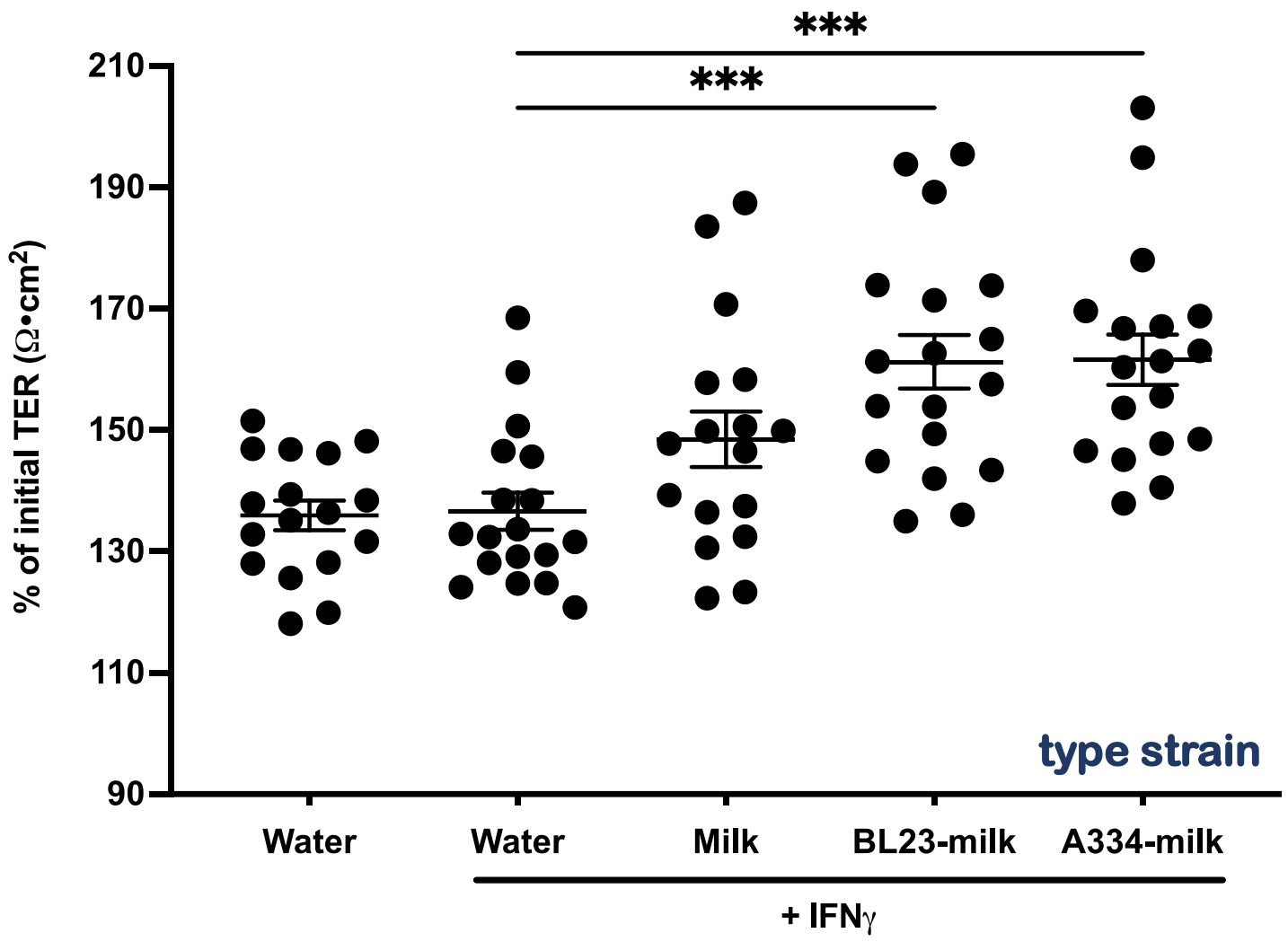
25% v/v *L. paracasei* fermented UHT milk (FUHT)

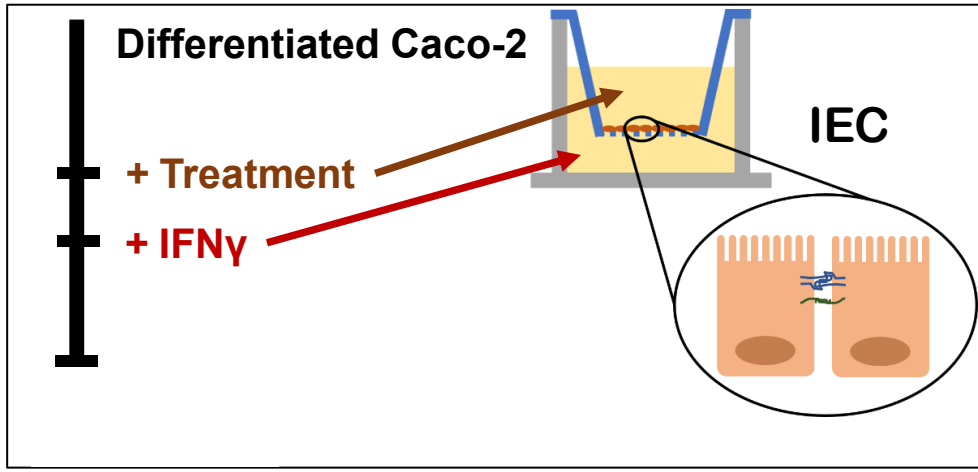
TNFR2 - TNF receptor

MLCK – myosin light-chain kinase

Zhai *et al* 2019 J Ag Food Sci

L. paracasei fermented milk - IFNγ interactions





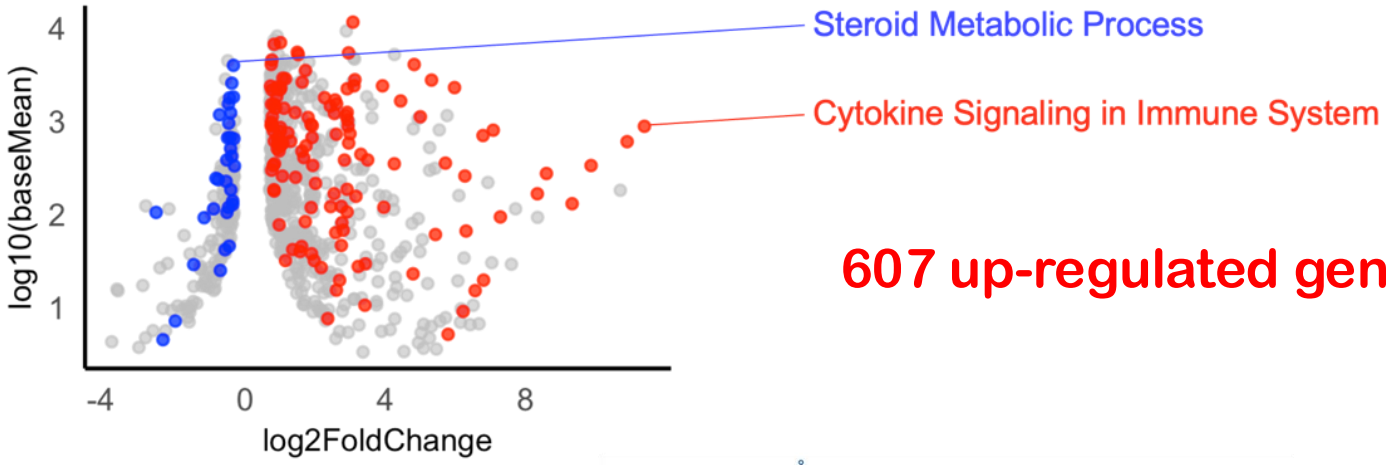
IFNγ (100 ng/ml)

***p < 0.0005 according to Kruskal Wallis and Dunn's multiple comparisons test

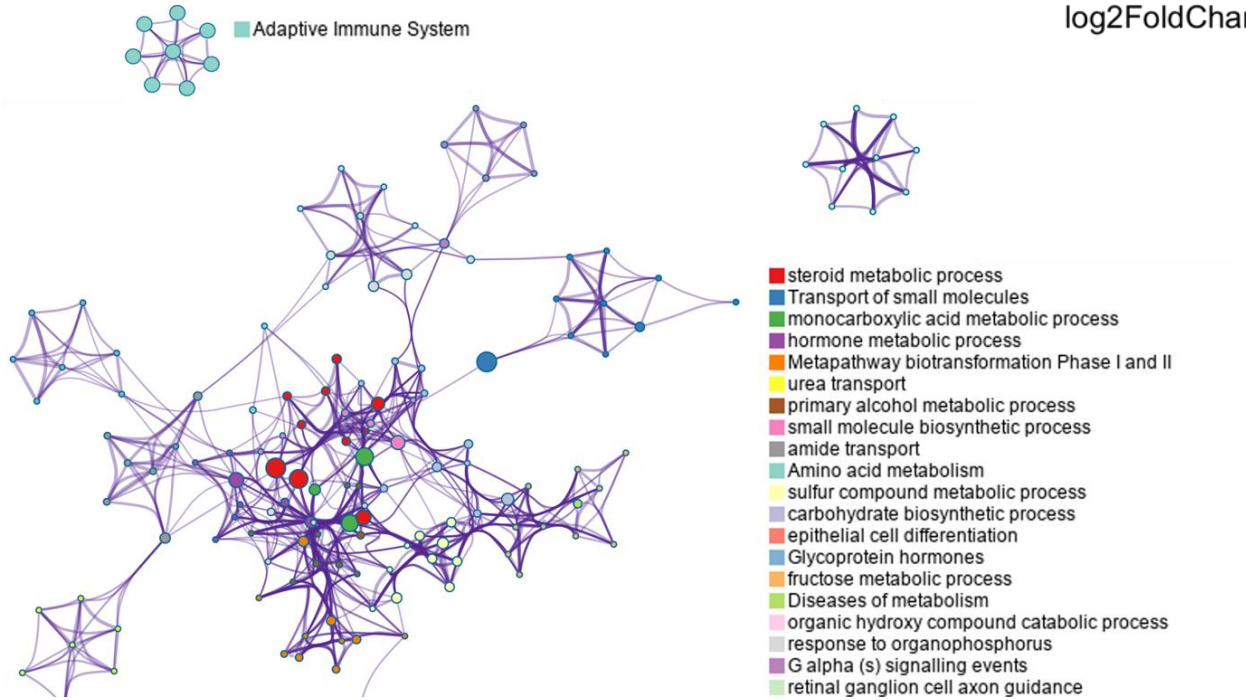
Bui *et al submitted*

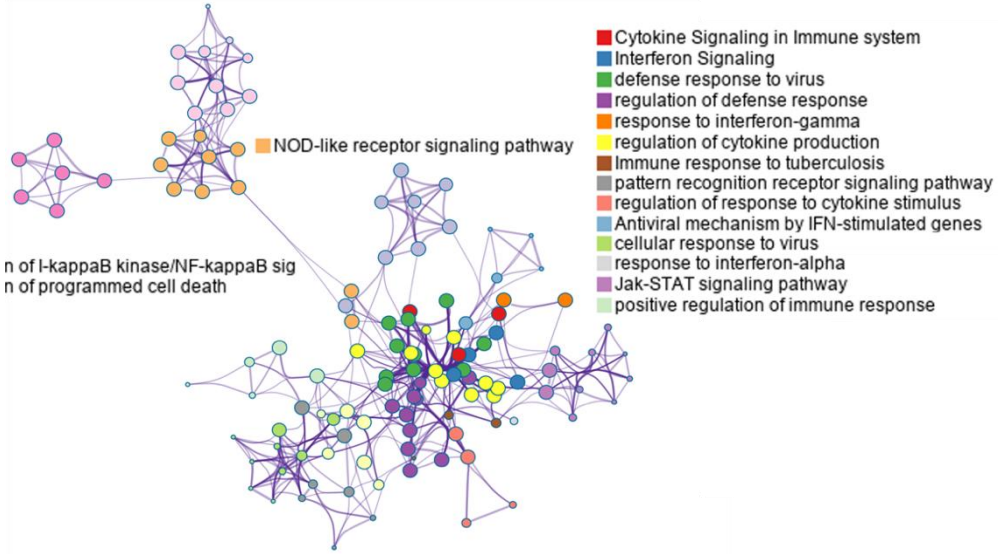
Intestinal cells respond to IFNγ

152 down-regulated genes



607 up-regulated genes

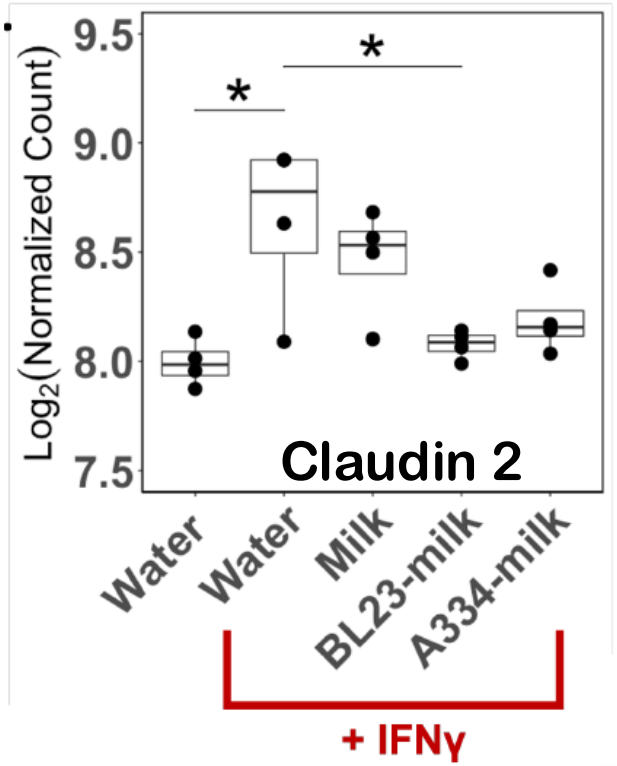




Network map of (Metascape). Node size reflects gene count, node color signifies cluster function, connecting lines indicate similar terms

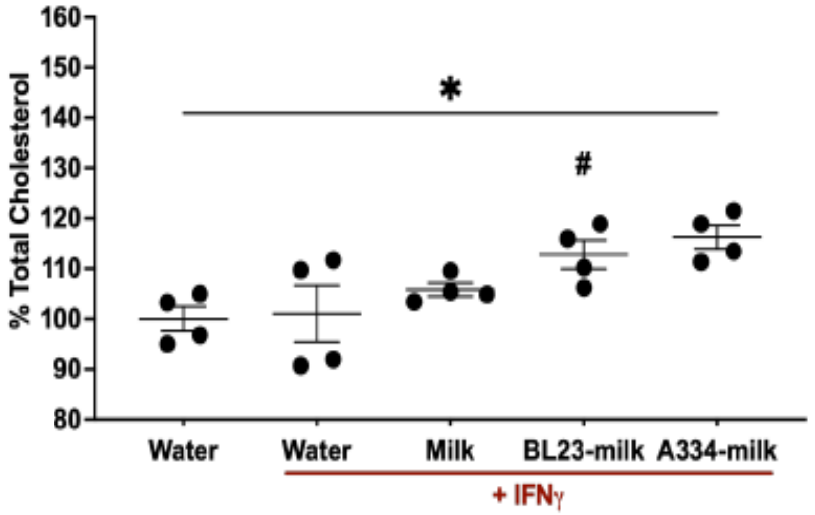
Bui *et al submitted*

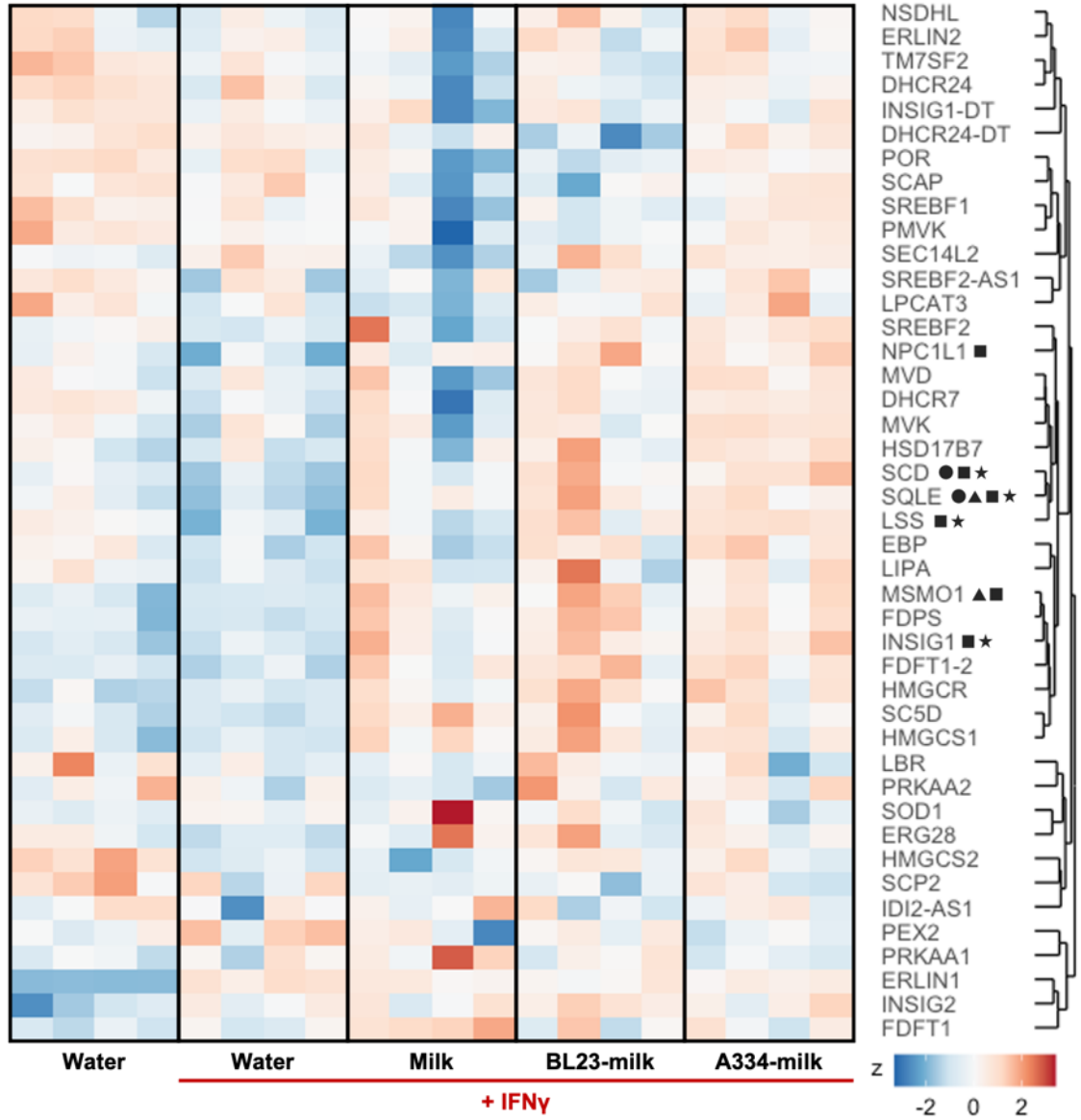
L. paracasei fermented milk prevents IFNγ changes to IEC



Sterol metabolism

normalized read counts across all genes associated with sterol biosynthesis

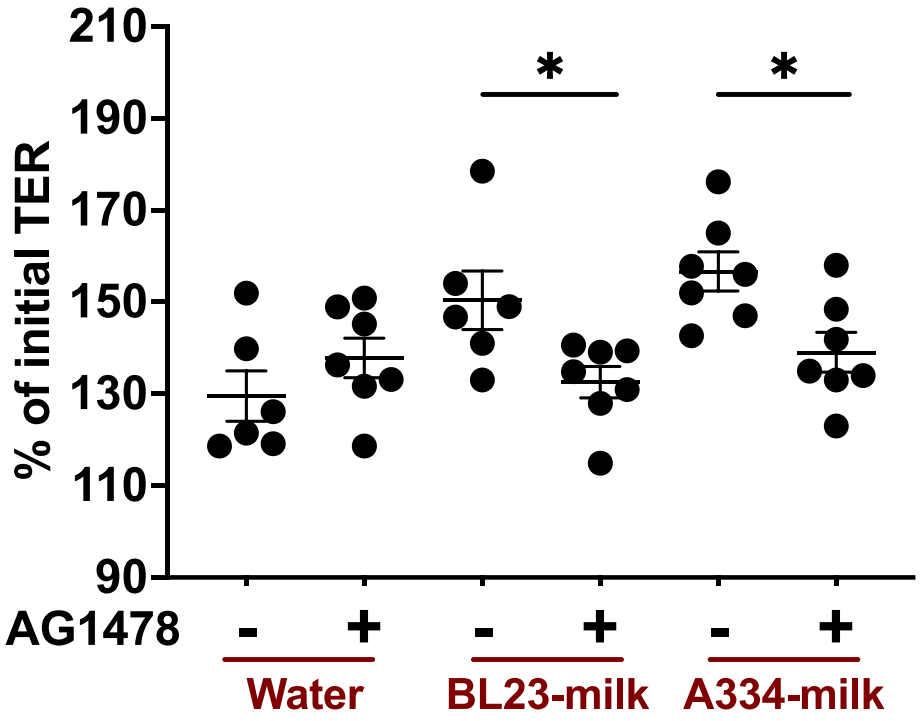




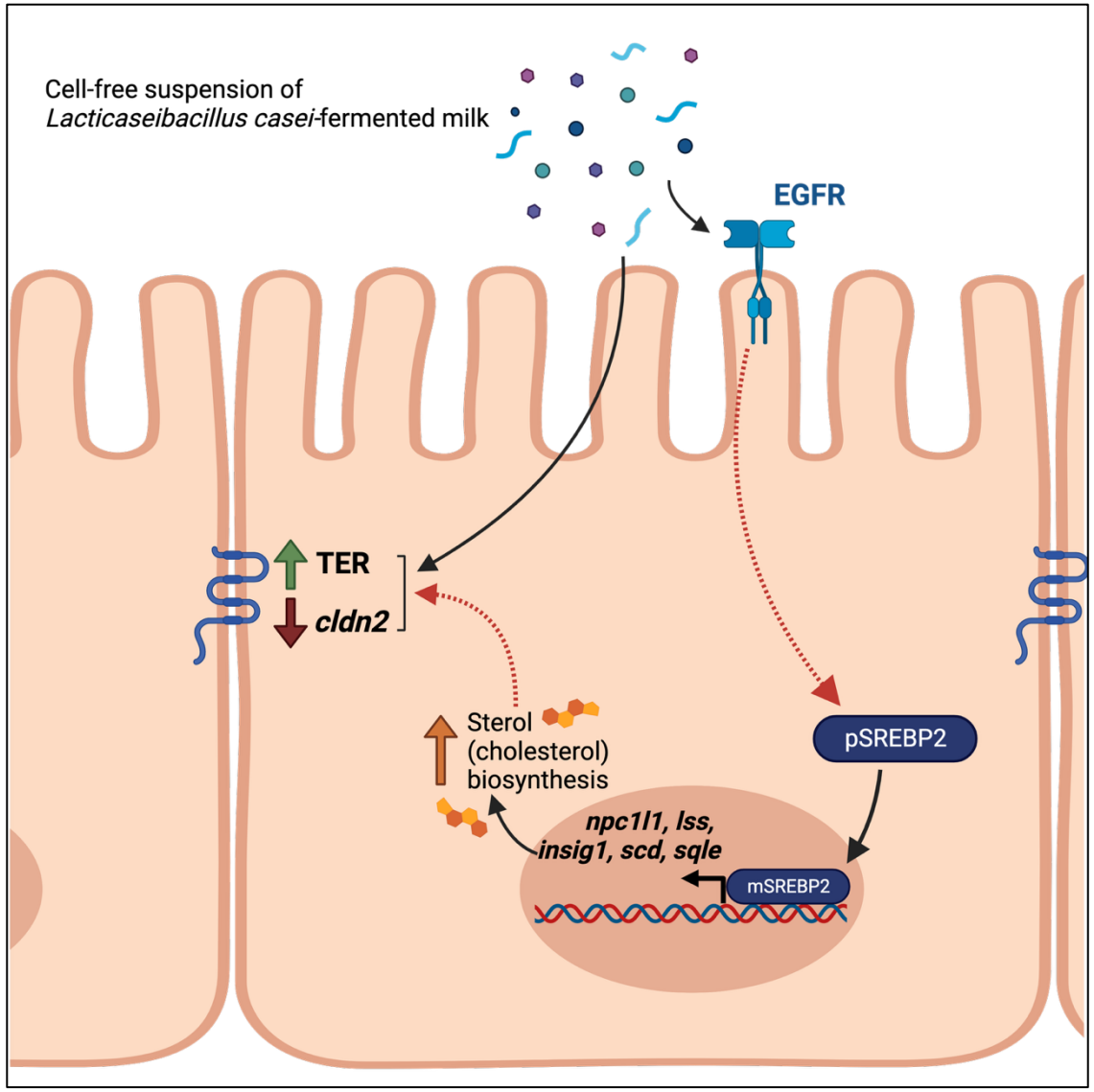
* P < 0.05 Kruskal Wallis

Bui *et al submitted*

Model for *L. paracasei* fermented milk – IEC interactions



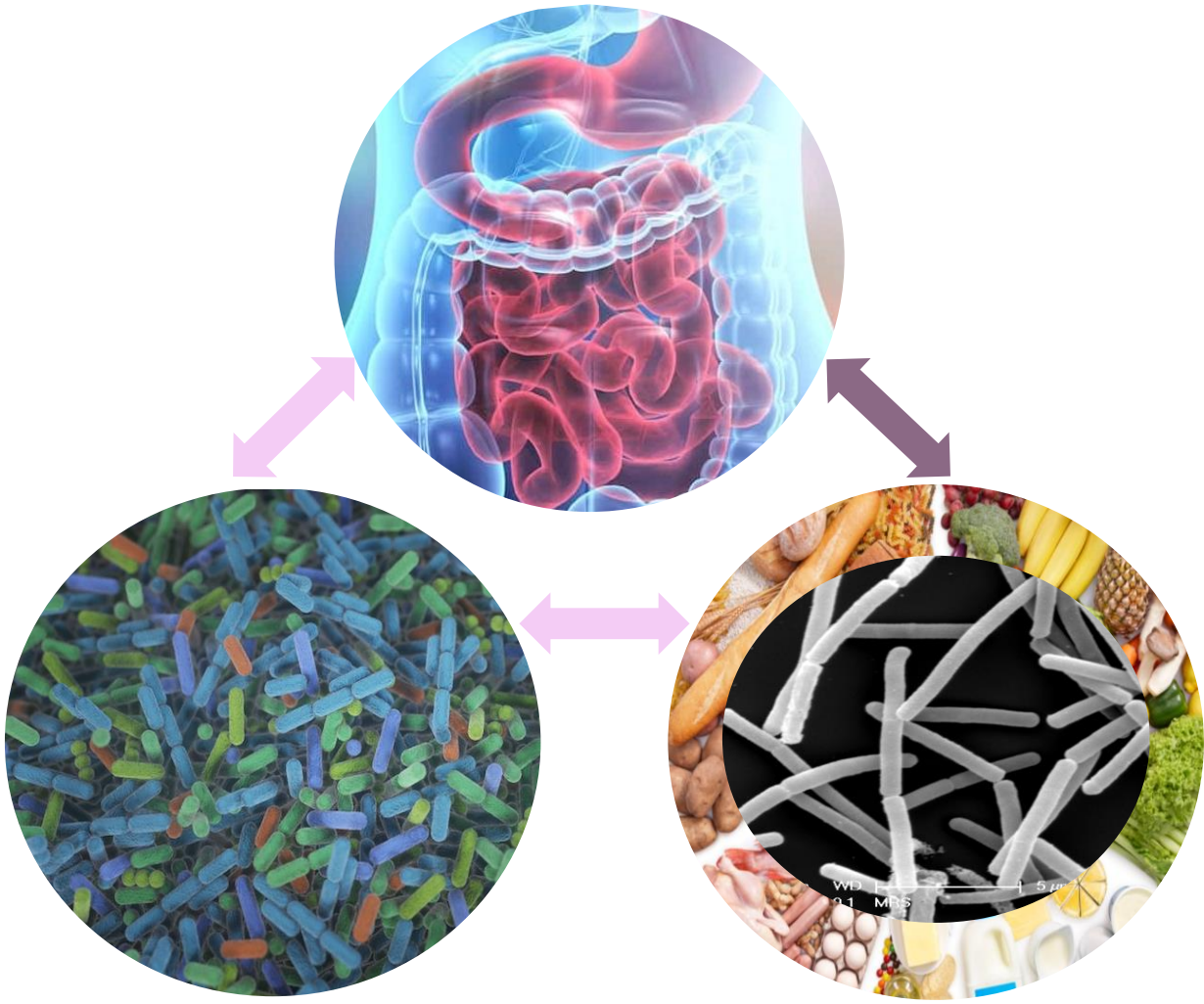
AG1478: Antagonist of the Epidermal Growth Factor Receptor (EGFR)



Bui *et al submitted*

Conclusions

- Fermented dairy foods provide a “complete package” of beneficial microbial microbes and compounds.
- Fermented dairy foods support gut health by modulation of key domains: intestinal barrier function, immunity, & the gut microbiome.
- Fermented dairy foods can be designed for health benefits, directed to different populations (age, health status, etc).



Gut microbiome

Dietary microbes

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Alejandra Meija - Caballero, PhD
Lei Wei, PhD
Kunal Dixit, PhD
Vi Pham, PhD
Jingzhang Feng, PhD
Haelee Lee
Yvette Morales
Siqi Wu
Sahana Mohan
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Eat.lac.project

Marcolab