

UNLOCKING OUR MICROBIOME



TNO innovation
for life

TNO combines state of the art technologies, such as organoids, high throughput sequencing and computational modelling to gain insight and discover functionalities in complex biological systems, to unlock our microbiome for your applications.

Our microbiome analysis and modelling techniques can help in solving questions, such as:
How does this ingredient influence the microbiome composition?
Can my ingredient suppress outgrowth of pathogens?
Will these fibers be metabolized by our microbiome?

HOW CAN OUR TECHNOLOGIES HELP YOU IN TODAY'S MARKET?

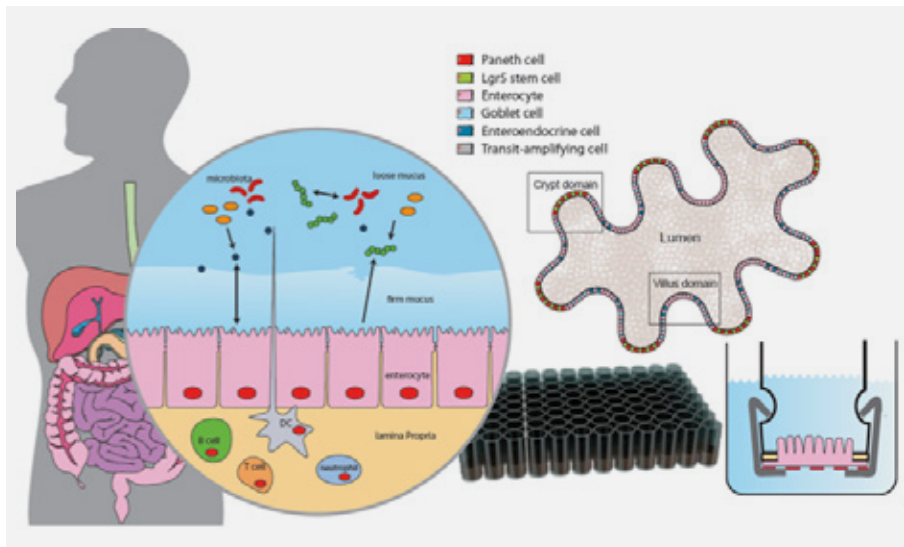
Every day, more insight in beneficial microbial ecosystems is generated. But how are these related to our health and wellbeing? And how can your product enhance this relationship between our microbes and our-selves? How can we scientifically support a relation between microbiome shifts and health? Which ingredient supports a healthy function such as gut wall integrity?

TNO offers an integrated approach to combine the understanding of our microbiota and the host responses. Unraveling this complex system of interactions can offer you a guide in your product innovation.

TNO'S CONTRIBUTION TO YOUR PRODUCT INNOVATION

By combining different models, analytical methods and modelling technologies, we offer a flexible approach specific for your question. Using the output from these models in our unique molecular tools and software pipeline, valuable data are generated in a high throughput manner. Advanced data warehousing and state of the art data handling, such as computational modelling, give insights in the complex interactions.

The combination of our expertise in microbiology, ecology, functional genomics and cell biology enables us to improve our understanding of the interactions between gut microbes and their hosts.



The human gut and TNO's in vitro systems

TNO'S TOOLBOX

Experimental models:

- › Organoids: stem cell based microorgans
- › InTESTine: ex vivo intestinal tissue to study gut wall processes
- › I-screen platform: high throughput gut system for ingredient screening
- › Human studies
- › Accelerated Mass Spectrometry (AMS)
- › Phenotypic resilience as health quantifier

Analytical toolbox:

- › Whole genome sequencing
- › Sequence based microbial profiling
- › Metagenomics
- › Meta transcriptomics

Computational technologies:

- › Network biology
- › Machine learning methods
- › Advanced data-bases

EXAMPLES

Modelling of nasopharyngeal microbial ecosystems in humans has provided a proof-of-principle for the relationship between microbiota composition and pathogen resistance. In this approach, samples were taken from the nasopharyngeal space in infants. The microbiota profiles were determined by advanced molecular technologies.

Integrated, multilevel models, that link microbiota composition with health outcomes, provide us with the characteristics of a healthy and beneficial microbiota profile. These characteristics support the discovery of new opportunities for nutritional interventions, to optimize the upper respiratory health.

To assess the role of the gut microbiota in human metabolism, 10 individuals were given a high fat diet for 4 weeks. Their fecal microbiota composition and host

response patterns of metabolic and inflammatory markers were monitored and data was processed in a correlation network approach. We revealed correlations between the diet and shifts in specific microbial niches, as well as correlations between these microbial changes and markers for inflammation. The gut microbiota proved to be a relevant factor in the assessment of metabolic health and flexibility. Understanding of these host-microbiome interactions aids the design of nutritional strategies that act via modulation of the microbiota.

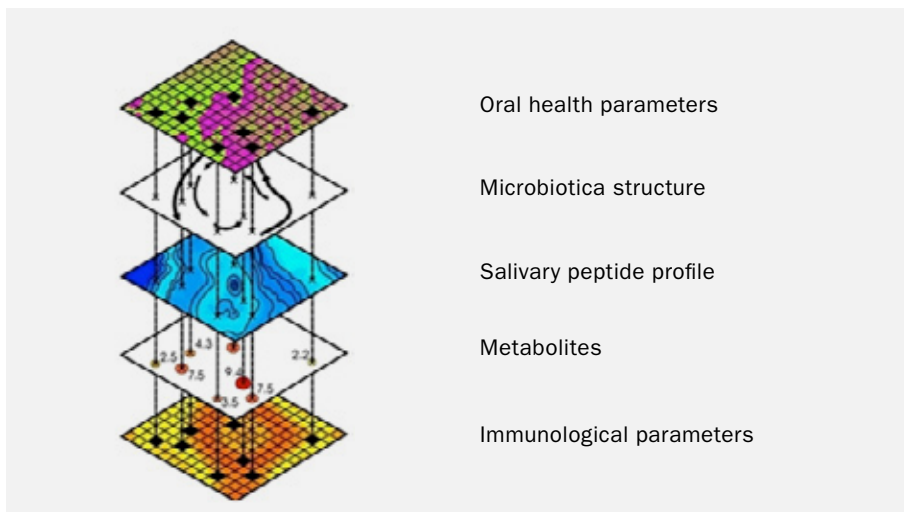
BUSINESS MODELS

We offer open innovation collaborations as well as confidential contract research.

REFERENCES

Biesbroek et al. (2014) Am J Respir Crit Care Med.;190(3):298-308
 Lukovac et al. (2014) mBio;5(4):e01438
 Kelder et al. (2014) Nutrition & Diabetes; 4:e122

TNO.NL



Multilevel approach in modelling

TNO HEALTHY LIVING

TNO initiates technological and societal innovation for healthy living and a dynamic society.

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