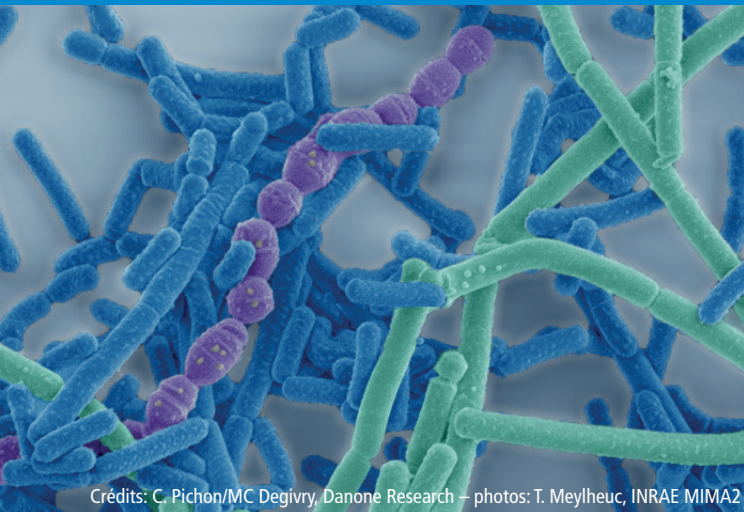


# Improve your gut microbiome!

Report on Danone's symposium at the international congress Nutrition 2021



Crédits: C. Pichon/MC Degivry, Danone Research – photos: T. Meylheuc, INRAE MIMAZ

Around the world, scientists are gradually recognizing significant correlations with the gut microbiome: nutrition affects the microbiome and the microbiome affects health. On the occasion of the international congress Nutrition 2021, approximately 260 participants accepted Danone's invitation to attend the virtual symposium on June 24, 2021. Here, three of the most renowned scientists in this field presented the current state of research.

The symposium dealt with two leading questions: Is the microbiome really influenced by nutrition and what effects do bacteria have on health events in their host? After Nutrition 2021, it is clear that the advice to "**Improve your gut microbiome!**" has now been scientifically validated.

## Here are the key messages of current research findings:

- The microbiome serves many functions: It produces bioactive metabolites, regulates immunity and the human energy homeostasis, and protects against pathogens. The extent to which these functions can be carried out depends on the quantity and quality of intestinal bacteria as well as their metabolic potential.
- The gut microbiome is a highly complex community that develops and adapts to its host throughout life.
- Host diet and genetics shape the gut microbiome and vary.
- Dietary nutrient content and timing of nutrient intake are now considered key regulators of microbiome and health.
- The interactions between inherited immunity and diet influence human metabolic health.
- The gut microbiome can be used as a biomarker to predict the response to specific dietary components. However, the development of precise diets for an "individually desirable microbiome" and interventions aimed at achieving optimal health are still in their infancy.
- The modulation of the human intestinal microbiota by means of probiotics, prebiotics (e.g. dietary fiber) is a recognized strategy for improving health and preventing disease.

## Improve your gut microbiome! Nutrition: evidence found?

### Food leaves a fingerprint in the microbiome

For many years, **Dirk Haller** has been conducting research on how nutrition and food shape the microbiome and what consequences this has on the human metabolism. **He emphasizes that food leaves its fingerprint in the microbiome.** Using modern analytical methods, scientists have been able to show how diverse the intestinal colonization in children and adults is – depending on the country, the region and the food they eat. The microbiome varies greatly from one individual to the next, which is why only a few disease patterns can be gleaned from the composition of the microbiome<sup>1</sup>. However, one thing is for sure: **Dietary patterns alter a person's microbiota and have a lasting impact on the hereditary immune system.** For example, a persistent oversupply of calories to the body or an undersupply of fiber often leads to a loss of **diversity in the microbiota**, culminating in functional dysbiosis. If the condition persists, it can damage the intestine's barrier function between the body and the environment. New research findings in this context show that part of the bacteria is only active at certain times of the day<sup>2</sup>. Experts are currently investigating the influence of the daily rhythm of bacteria on health developments. Today, it is no longer doubted that a person's microbiome can be understood as an individual fingerprint of their metabolic situation. However, whether it can also be "personalized", i.e. adapted to mitigate individual risk factors through targeted intervention – is still an open question. Dirk Haller emphasizes that "a personalized microbiome definitely also requires a personalized diet as well."

1 Metwaly, Reitmeier, Haller (2021) Nat. Rev. Gastroenterol. Hepatol. (under review). Find the pattern!?

2 Reitmeier et al. Haller (2020): Cell Host Microbe 2020 Aug 12;28(2):258-272.e6

### The microbiome interacts with other organs

**Philip Calder** is a specialist in the interaction of the microbiome with the immune system. He asserts that a well-functioning immune system is the key to a good defense against pathogenic organisms. **The gut microbiome shapes the gut-associated immune system and vice versa.** A wide variety of organ systems benefit from this fact, which means that events at gut level can have effects on the periphery of the body. Thus, human studies confirm the existence of a gut-lung axis and a gut-brain axis. An intact gut microbiome performs important signaling functions in both systems. According to Calder, many human studies suggest that prebiotics and probiotics improve the body's immune responses to external stimuli, with probiotics working in a strain-specific manner. Some probiotics have already demonstrated their benefit in childhood diarrhea events<sup>3</sup>. Other probiotics reduce the risk of antibiotic-associated diarrhea in adults<sup>4,5,6</sup>. Positive effects of probiotics on the risk and duration of (upper) respiratory tract infections in children and adults have been shown in human studies<sup>7</sup>.

The improved immune responses of the body to vaccination after administration of probiotics are also known today<sup>8</sup>. **Studies showing improved immune responses and reduced infections generally used lactobacilli and bifidobacteria.** Calder summarizes their effect in the following way: Probiotics, preempt the colonization of pathogenic intestinal bacteria. Additionally, they also improve functional processes of the immune system and defend the host against bacteria and viruses. Both mechanisms ultimately have one common effect in that they reduce infections.

3 Malagón-Rojas et al. (2020) Nutrients 12, 389.

4 Allen et al. (2010): Cochrane Database Syst Rev CD003048

5 Hempel et al. (2012): JAMA 307, 1959-1969

6 Jafarnejad et al. (2016): Nutr Clin Pract 31, 502-513

7 King et al (2014): Br J Nutr 112, 41-54

8 Rizzardini et al. (2012) Brit. J. Nutr. 107, 876-884

## Nutrition as the beat of life

**Sandra Holasek** summarized the current state of research with respect to the background of the eating behavior of the population in three points. In her view, the new knowledge underpins the fact that firstly, nutrition requires a holistic approach in which food is of key importance. Nutrition plays an important role in setting the pace of life. Secondly, it is the diversity of the microbiome that is critical to health. People can only achieve this by eating the most diverse diet possible. The recommendations for the population (food pyramid, plate models, etc.) already

specify this daily diversity. **Thirdly, it is important to pay attention to the "three Ps" (prebiotics, probiotics and polyphenols), which can result in a healthy microbiome.** With the help of the Planetary Health Diet, these recommendations can be implemented very well, especially by eating dairy products on a daily basis and by giving a high priority to plant-based foods in one's everyday diet.

### About the scientists:



**Prof. Haller** conducts research in the field of nutritional science. His main focus is on bacteria in the gut and their role in chronic inflammatory diseases and carcinogenesis. He specializes in the microbial ecosystem of the gut and its barrier and immune functions. Prof. Haller heads the Department of Nutrition and Immunology and the Central Institute Food & Health at the TUM Campus Weihenstephan.



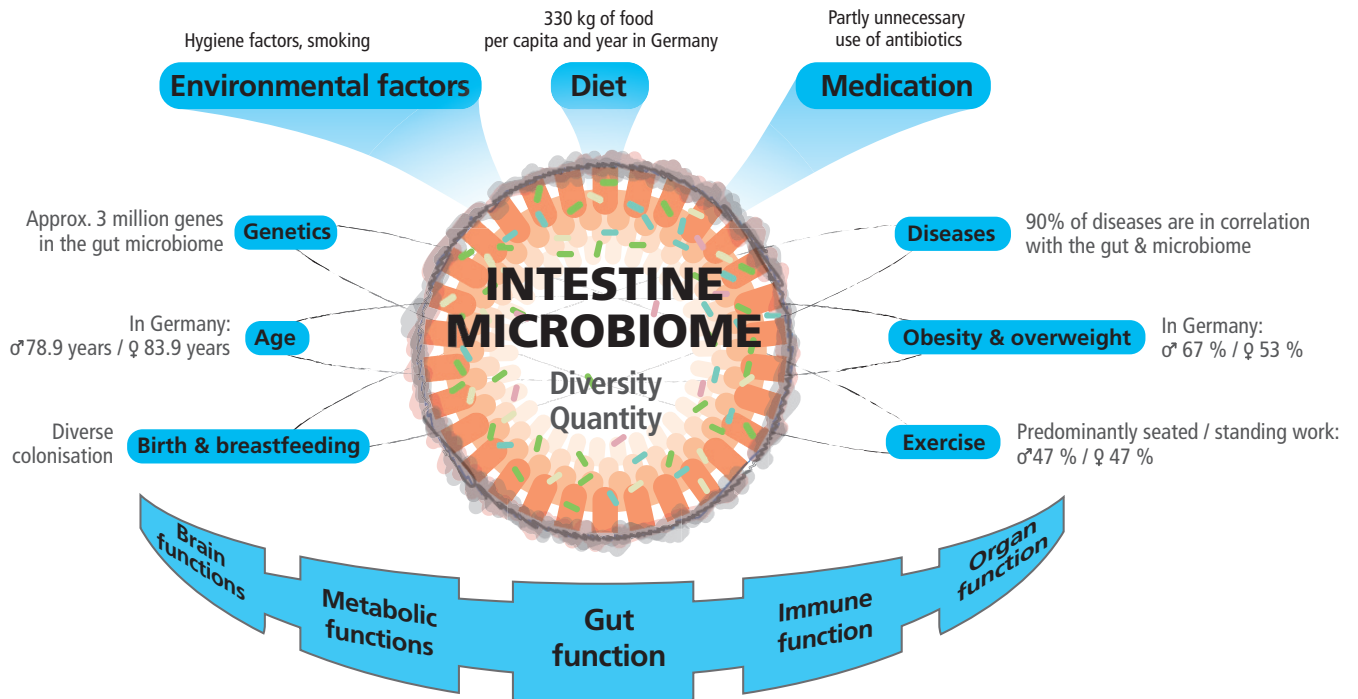
**Prof. Calder** researches how diet influences the function of the human body. His focus is on the modulation of immunity and inflammatory processes as well as how nutrition influences cardiometabolic risks. An important part of his research is devoted to the metabolic processes of fatty acids. He is Professor of Nutritional Immunology and heads the School of Human Development & Health at the University of Southampton.



**Prof. Holasek's** main scientific interests are pathophysiology and internal medicine, energy metabolism and eating behavior in humans. She conducts research at the Otto Loewi Research Center, Chair of Immunology and Pathophysiology, which focuses intensively on vascular biology, immunology and inflammatory processes in the human body. She heads the research unit "Nutrition Research/Nutrition and Metabolism" there and is vice president of the Austrian Society for Nutrition.

**Transparency:** The experts were invited to Danone's satellite symposium in their capacity as critical discussants from the scientific community. They received an expense allowance from the organizer DANONE.

# Improve your microbiome!

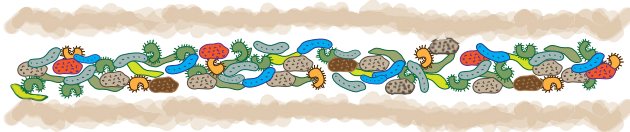


<sup>1</sup> according to Hill C (2020)

### Positive effects of optimal gut function: <sup>[2,3,4,5]</sup>

Improved food utilisation | Reduced chances of survival of pathogenic germs | Neutralisation of toxins and mutagens  
| Improvement of metabolic parameters | Maintenance of barrier function |  
Immune modulation | Energy metabolism

### With a balanced diet and lifestyle:

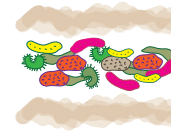


Balanced microbiota

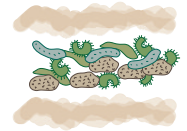
### With unbalanced diet and lifestyle:



Decrease in health-promoting bacterial species



Increase in pathogenic bacterial species



Decrease in bacterial species diversity

## What to do? Measures with evidence

### Promote eubiosis

- Fermented products (vegetables, juices, yoghurt) <sup>[6,7,8]</sup>
- Herbal food (as raw and fresh as possible) <sup>[9,10,11]</sup>
- Living microorganisms (probiotic yoghurt/drinks) <sup>[12,13,14,15]</sup>
- Dietary fibre (whole grains, legumes, prebiotics) <sup>[16,17]</sup>
- Make use of preventive offers (preventive healthcare)

### Avoid dysbiosis

- Energy density (salty snacks, sweets, high calorie drinks) <sup>[18,19,20,21]</sup>
- Animal foods (processed red meat) <sup>[22,23]</sup>
- Negative stress (stress factor cortisol release) <sup>[24]</sup>
- Sitting, standing, lying down (reduced gut movement) <sup>[25,26]</sup>

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- <sup>1</sup> Erweiterte Grafik nach Hill C (2020): Gut Microbiome 1, E3 | <sup>2</sup> Haller, D. et al (2015): Springer Spektrum. Fachmedien Wiesbaden. | <sup>3</sup> Bischoff, S. (2017): Internist; 58; 441-448. | <sup>4</sup> Hahn, A (2016): Ernährung. Wiss. Verlagsgesellschaft. 3. Aufl. 549ff | <sup>5</sup> Miles E, Calder P (2020): Nutrients. ISBN 978-3-03921-613-0 (PDF) | <sup>6</sup> Pasolli E et al. (2020): Nat Commun 11, 2610. | <sup>7</sup> Timon CM et al. (2020): Nutrients 12(10): 3040. | <sup>8</sup> Luo X et al. (2020): Eur J Nutr 60(2):929-938. | <sup>9</sup> Garcia-Manzana I et al (2018): Front. Microbiol: 9. | <sup>10</sup> Mazocchi A (2019): Nutrients (11): 2941. | <sup>11</sup> Gavahian, M. (2020): Foods (9): 1014. | <sup>12</sup> Sanders ME et al. (2019): Nat Rev Gastroenterol Hepatol 16(10):605-616. | <sup>13</sup> Poon t (2020): Nutrients, 12(11), 3443; | <sup>14</sup> Hills R; (2019): Nutrients (11): 1613 | <sup>15</sup> Koutnikova H: BMJ Open 2019;9: e017995 | <sup>16</sup> Blaut M; (2015): Aktuelle Ernährungsmedizin (40 (01)): 43-49 | <sup>17</sup> Vitaglione P (2015): Am J Clin Nutr (101 (2)): 251-61 | <sup>18</sup> Guo, X (2017): Mediators Inflamm. 2017. 9474896. | <sup>19</sup> Araújo JR (2017): Biochimie (141): 97-106. | <sup>20</sup> Wilck, N (2017): Nature (551): 585-589. <sup>7</sup> Lederq S (2019): Alcohol (74):105-111. | <sup>22</sup> Zhu C et al (2020): Nutr. Res (77): 62-72. | <sup>23</sup> Zaramela L.S. et al (2019): Nat. Microbiol. (4), 2082-2089. | <sup>24</sup> Mördl S (2020): Neuropsychobiology (79):80-88. | <sup>25</sup> Mohr, A; (2020): J Int Soc Sports Nutr. (17): 24 | <sup>26</sup> BZgA (2017): Nationale Empfehlung für Bewegung und Bewegungsförderung.

