

Webinar on NATURAL PRODUCTS, CAM THERAPIES, AND TRADITIONAL CHINESE MEDICINE

July 04, 2022 | Webinar



Martin Kussmann

German Entrepreneurship, USA

Received date: 02-04-2022 | Accepted date: 04-04-2022 | Published date: 08-07-2022

Nature has the answers: Discovering, validating, and better understanding natural bioactives for human health

Nature has the answer to almost all our questions about human health. Natural bioactives, especially when derived from sustainable plant and food sources¹, provide a plethora of molecular solutions to nutritionally actionable, chronic conditions. The spectrum of these conditions, such as metabolic, immune, and gastrointestinal disorders, has changed with prolonged human life span, which should be matched with an appropriately extended health span: “adding years to life and adding life to years”².

Natural bioactives can be classified into (a) micronutrients (i.e. vitamins, essential fatty and amino acids, minerals)³; (b) phytonutrients (e.g. polyphenols)⁴; (c) bioactive peptides⁵; and (d) pre- and probiotics⁶. While discovery and validation of single micronutrients have been accomplished in the 20th century, their interactive functions and holistic benefits for health have only become recently appreciated⁷, within the concept of ‘systems health’: “we are not eating single molecules, but complex diets”. Phytonutrients form an established body of (e.g. immune and metabolic) health-beneficial compounds, yet the vast majority of these bioactives remains to be discovered. Likewise, bioactive peptides have remained largely underexploited as molecular means for health promotion, mainly due to the following reasons⁵: (a) (assumed-to-be) poor bioavailability after oral consumption due to breakdown along the gastrointestinal tract; (b) limited transport from gut to blood; and, importantly, (c) inefficient discovery and translation based on serendipitous research and/or high-throughput screening. Pre- and probiotics, as parts of the intestinal microbiome, can be more efficiently discovered and validated by an integrative, symbiotic, ‘seeding through feeding’ strategy⁶.

The future of translational science on natural bioactives is being built on (a) the systems-level rather than the reductionist approach to understanding their interdependent, and at times synergistic, functions⁸; and (b) the leverage of artificial intelligence for discovery and validation, thereby dramatically reducing the time from idea and concept to finished solutions for consumers and patients.



Figure 1: Natural bioactives and epigenetics: one-carbon and tetrahydrofolate cycles. Dietary components shown in boxes: vitamins (gray) and other organics (black). Methyltransferases use S-adenosylmethionine to transfer a methyl group to macro- and small molecules.

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Recent Publications:

1. Kaput, J., Kussmann, M., Mendoza, Y. et al. Enabling nutrient security and sustainability through systems research. *Genes Nutr* 10, 12 (2015).
2. Monteiro JP, Kussmann M, Kaput J. The genomics of micronutrient requirements. *Genes Nutr*. 2015;10(4):466.
3. Barrera-Reyes PK, Cortés-Fernández de Lara J, Poquet L, Redeuil K, Kussmann M, Silva-Zolezzi I, Tejero EM. Circulating Structurally Related (-)-Epicatechin Metabolite Species and Levels after Sustained Intake of a Cocoa Powder High in Polyphenols Are Comparable to Those Achieved after a Single Dose. *Nutrients*. 2021 Oct 27;13(11):3829. doi: 10.3390/nu13113829. PMID: 34836088; PMCID: PMC8625154.
4. Doherty A, Wall A, Khaldi N and Kussmann M (2021) Artificial Intelligence in Functional Food Ingredient Discovery and Characterisation: A Focus on Bioactive Plant and Food Peptides. *Front. Genet.* 12:768979. doi: 10.3389/fgene.2021.768979

Biography

Martin Kussmann is the Chief Scientific Officer at Nuritas, which combines artificial with human intelligence to discover and validate bioactive peptides from plants and foods. Biochemist by training, he has accomplished a 30-year career at the private/public research interface with experience in nutrition, pharma, and biotechnology. He held professorships at EPF Lausanne, Switzerland; Aarhus University, Denmark; and Auckland University, New Zealand, where he was also the Scientific Director of the National Science Program on Food Innovation. His research focuses on translational human studies in nutrition and health, with an emphasis on metabolic, immune, and gastrointestinal health, and their positive modulation by natural bioactives such as micronutrients, phytonutrients, pre- and probiotics, and bioactive peptides. He integrates omics and artificial intelligence-based discovery and validation of natural products with clinical validation in human.

martin@kussmann.ch