cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

POSITIVe
FA 1403

Final Conference

Sept 25-26TH
2018

LISBON – PORTUGAL
Campolide Campus

In satellite to:

2ND CONFERENCE ON
FOOD BIOACTIVES & HEALTH
26-28 SEPTEMBER 2018 LISBON PT

WELCOME MESSAGE

Final Scientific Conference of COST Action POSITIVe - FA1403

"Interindividual variation in response to consumption of plant food bioactives and determinants involved"
POSITIVe website: http://www6.inra.fr/cost-positive

The COST Action POSITIVe FA1403 was launched in December 2014 and has been actively working for the past 4 years to advance in the understanding of the benefits of plant food bioactives for human health and specifically looking at the individual responses to the intake of these compounds considering the potential factors responsible of the interindividual variation, regarding both their bioavailability and metabolism and their bioefficacy to improve cardiometabolic health. Researchers from over 70 research institutions from 32 European countries have periodically met and discussed the current research, have collaborated *via* regular STSM and visits between laboratories and have revised and updated the literature by means of a number of important publications collecting state-of the-art knowledge in the field.This Final COST Conference is the ideal scenario to present all the results of this impressive common effort and to further discuss the current unresolved issues and the way to future research in the area of personalized nutrition as one of the important tools to combat cardiometabolic human disorders. We have also invited a number of external speakers expert in the area of personalized nutrition as well as representatives of the consumers research area and various stakeholders with an interest in personalized nutrition and plant bioactive compounds for health applications. The debates between all of them promise to be very informative and constructive for future research and applications.

You are all very welcome to join us in this exciting and interesting event which will be followed by the 2nd edition of the Food Bioactives and Health Conference. A whole week of excellent science and discussions.
We sincerely hope you enjoy it!

On behalf the Steering Committee

Christine Morand,
Chair of FA1403 POSITIVe

Francisco Tomas-Barberan,
co-chair of FA1403 POSITIVe

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- Dr Eileen Gibney, University College Dublin, Ireland
- Prof Marina Heinonen, University of Helsinki, Finland
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- Dr Claudine Manach, INRA, Clermont Ferrand, France
- Dr Pedro Mena, University of Parma, Italy
- Dr Dragan Milenkovic, INRA, Clermont Ferrand , France
- Dr Christine Morand, INRA, Clermont Ferrand, France
- Dr Ana Rodriguez-Mateos, Kings College London, UK
- Prof Baukje de Roos, University of Aberdeen, United Kingdom
- Prof Francisco Tomas-Barberan, CEBAS-CSIC, Murcia, Spain
- Prof Tom Van de Wiele, Ghent University, Belgium

Acknowledgement

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Detailed information about the COST association can be found at http://www.cost.eu/

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COMMITTEES

Final Scientific Conference of COST Action POSITIVe - FA1403

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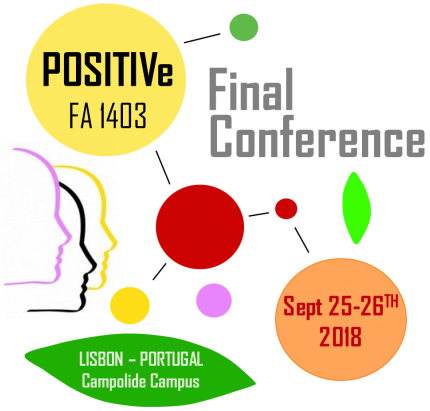

SCIENTIFIC PROGRAM

Tuesday, 25th September 2018 **8.00 a.m. – 8.45 a.m. Welcome** (8.45 a.m. – 17.30 p.m.) ***Main Findings from POSITIVe: Major determinants involved in interindividual variations in plant food bioactives ADME and cardiometabolic responses***	
Morning session 8.45 – 12.25	
8.45 – 9.00	Dr. Christine Morand (INRA-Clermont –Ferrand, France) ***Introduction of the COST Action POSITIVe – Final Conference***
9.00 – 9.35	Dr. Tom van de Wiele (University of Ghent, Belgium) ***Determinants of interindividual variability in absorption, distribution, metabolism and excretion of plant food bioactives***
9.35 – 10.10	Dr. Torsten Bohn (Luxembourg Institute of Health, Strassen, Luxembourg) ***ß-Carotene in Humans – Metabolic Pathway and Bioactivation - from Digestion to Tissue Distribution and Excretion***
10.10 – 10.45	Dr. Anne Marie Minihanne, Univ of East Anglia, UK ***Key determinants of flavonoids metabolism following mixed dietary flavonoid source – COB Study***
BREAK	
11.15 – 11.50	Dr. Claudine Manach (National Institute for Agricultural Research-INRA, Clermont Ferrand, France) ***Untargeted metabolomics for assessment of true exposure to plant food bioactives***
11.50 – 12.25	Dr. Aleksandra Konic-Ristic (University of Belgrade, Serbia - University College Dublin, Ireland) ***Quality of reporting of clinical trials addressing the inter-individual variation in response to plant bioactives***
LUNCH	
Afternoon session 13.55 – 17.30	
13.55 – 14.30	Dr. Ana Rodriguez-Mateos (King's College, London, United Kingdom) ***Investigating variability in cardiometabolic response to plant food bioactives: approaches and main findings from POSITIVe***
14.30 – 15.05	Dr. Dragan Milenkovic, National Institute for Agricultural Research (INRA), Clermont Ferrand, France ***Evaluation of cell and molecular targets of plant food bioactives: implications for inter-individual variability***
15.05 – 15.40	Prof. Francisco Tomas-Barberan, CEBAS-CESIC, Murcia, Spain ***Impact of gut microbial metabolism on cardiometabolic markers***
BREAK	
16.10 – 16.45	Dr. Emilie Combet, University of Glasgow, UK ***Beyond results - lessons learned from POSITIVe meta analyses***
16.45 – 17.30	**ROUND TABLE "Future of plant food bioactives in precision nutrition"** Moderators: Chairs ; Participants : WG leaders, speakers, the audience Introduction : Prof. Baukje de Roos (University of Aberdeen, United Kingdom) ***POSITIVE roadmap***

SCIENTIFIC PROGRAM

Wednesday, 26th September 2018 (9.00 a.m. – 16.30 p.m.) ***Recent advances in research on interindividual variability and interesting perspectives in the field of personalized nutrition***	
Morning session 9.00 – 12.00 a.m.	
9.00 – 9.30	Dr. Eileen Gibney, University College of Dublin, Ireland ***Main findings from Food 4Me - Next steps***
9.30 – 10.00	Dr. Baukje de Roos, University of Abeerden, UK ***Personalized intervention: a precision approach for the next generation of intervention studies***
10.00 – 10.30	Dr. Kieran Tuohy (Fondazione Edmund Mach, Trento, Italy) ***Microbiome variants in relation to bioavailability of plant food bioactives***
BREAK	
11.00 – 11.30	Prof.Rikard Landberg, Chalmers University of Technology, Gothenburg, Sweden ***New personalized strategies for optimal metabolic responses to fibre-rich foods***
11.30 – 12.00	Dr. Paul Franks, University of Lund, Sweden ***Lifestyle in the context of precision medicine***
LUNCH	
Afternoon session 13.30 – 16.30 p.m.	
13.30 – 14.00	Prof. Wim Verbeke (University of Ghent, Belgium) ***Personal determinants of consumers' healthy and sustainable food choices***
14.00 – 14.15	Dr. Pascale Fanca Berthon (Head of Nutrition & Health Science, Naturex, France) ***From science to market: challenges of personalized nutrition with botanicals***
14.15 – 14.30	Dr. Carlos Javier González Navarro (Director of Innovation, Centre for Nutrition Research, University of Navarra, Spain) ***Food innovation and personalized nutrition: What is (Spanish) industry demanding from scientists and technologists***
14.30 – 14.45	Dr. Marjan van Erk (TNO; program manager public-private consortium on Personalised Nutrition & Health, The Netherlands) ***Technologies and knowledge for tailored, scientifically grounded products and services in personalized nutrition.***
14.45 – 15.00	Dr Adrian Hodgson (Nutrition Innovation Consultant, SPOON-GURU, United Kingdom-USA) ***Artificial intelligence, machine learning and precision nutrition are transforming the way people eat and drink***
15.00 – 16.00	***Round Table: Debate on personalized nutrition and health with a panel of stakeholders*** (Moderator: Dr. María-Teresa García-Conesa, CEBAS-CSIC, Spain)
16.00 – 16.30	***Closing and group photos***

SPEAKERS' BIOGRAPHY AND ABSTRACT

Dr. Christine MORAND – Chair COST Action POSITIVe

National Institute for Agricultural Research-INRA, Clermont Ferrand, FRANCE

Dr Christine Morand is Research Director - Research Scientist (Nutritionist, Biochemist) at INRA, the French National Institute of Agricultural Research. She works in the Human Nutrition Unit in Clermont-Ferrand, where she leads a research group focused on "Diet, plant food bioactives and Vascular health". She is working in the field of Nutrition & Health to study the role of dietary polyphenols in the prevention of cardiovascular diseases through a translational approach. This research includes human intervention studies with non-invasive assessment of vascular function, supplementation studies in animal models of atherosclerosis and cell experiments on vascular and immune cells. Previously she worked on the absorption and metabolism of dietary polyphenols. Currently, she is the Chief Editor of the journal Food and Function (Royal Society of Chemistry, Cambridge, UK). **E-mail:** christine.morand@inra.fr

COST Action POSITIVE : **Interindividual variation in response to consumption of plant food bioactives and determinants involved**

To combat the burden of cardiometabolic disease, which constitutes a major public health issue in Europe, it is of crucial importance to develop strategies that target the dietary behaviours of European consumers and improve the food supply. Plant foods are rich sources of a large range of bioactive compounds that beneficially affect our health, particularly by decreasing the risk of cardiometabolic diseases. However, heterogeneity in individuals' responsiveness to plant food bioactives can obscure associations between dietary intakes and health, hinder the identification of health benefits for specific population groups and limit our understanding of the exact role of the different bioactives. POSITIVe specifically addresses inter-individual variation in bioavailability and physiological responses to consumption of plant food bioactives in relation to cardiometabolic endpoints. During these last four years, this Action has coordinated a multidisciplinary European network of experts, gathering efforts to harness and combine the currently fragmented knowledge and ensure the optimal translation of findings into concrete applications. A better understanding of the factors that cause this interindividual variation will help stakeholders in developing efficient strategies to optimise the beneficial effects of plant food consumption for everyone, by defining a new generation of dietary recommendations targeted to large population subgroups and by underpinning the development of new functional/customized foods.

Dr. Tom van de WIELE – WG1 leader COST Action POSITIVe

University of Ghent, BELGIUM

Associate professor at the Center for Microbial Ecology and Technology from the Faculty of Bioscience Engineering, Ghent University. The core expertise of his research group is the creation and application of enabling *in vitro* technologies that mimic the host-microbe interphase with particular focus on mucosal microenvironments. Model systems such as M-SHIME (a mucosa containing dynamic gut model) can be used to generate mechanistic insight in host-microbe interactions and complement *in vivo* observations. Such dynamic human gut models allow for the screening of a wide variety of candidate drugs, functional foods and/or feeds before a more narrow selection enters the stage of *in vivo* trials. The research of Tom Van de Wiele has resulted in a scientific output of more than 180 peer-reviewed international publications and the participation as invited speaker in many international conferences.
E-mail: Tom.VandeWiele@UGent.be

Determinants of interindividual variability in absorption, distribution, metabolism and excretion of plant food bioactives

The health effect of plant bioactives is determined by a vast array of determinants that directly or indirectly affect the pharmacokinetic processes of absorption, distribution, metabolism and excretion. Literature information on what determinants lay at the basis for explaining the huge interindividual variability in bioavailability is clouded by the complex interactions between these determinants and each individual's personal history and exposome. Working group 1 of the COST POSITIVe action organized itself in different subgroups to gather literature data and obtain concise overviews of what factors are most likely explaining bioavailability differences between individuals. As a phenotypic stratification of individuals is only obtained by an in-depth analysis of plant bioactives and their metabolites in body fluids, a metabolomics subgroup was created to explore the state-of-the-art analytical coverage and to facilitate the metabolomics support of online platforms that harness detailed information about dietary phytochemicals and their metabolites. Finally, using a proof-of-concept approach on a number of selected plant bioactives, a gene variant subgroup and a microbiome variant subgroup set out to explore those human genes and gut microorganisms that underlie crucial steps in the metabolic pathway for making a phytochemical or its metabolite bioavailable or not.

Dr. Torsten BOHN, WG member COST Action POSITIVe
Luxembourg Institute of Health, Strassen, LUXEMBOURG

PhD in Human Nutrition, Department of Food Science and Nutrition, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland. Between 2007 and 2015, he was Project and Research Unit Leader at the Luxembourg Institute of Science & Technology (LIST) and the CRP-Gabriel Lippmann (CRP-GL), Nutrition & Toxicology, Department of Agro-Biotechnologies, Belvaux, Luxembourg. He currently holds a position as Principal Investigator at the Luxembourg Institute of Health (LIH). He has a vast research experience in studies on phytochemicals (especially on carotenoids) and health, human nutrition and epidemiological studies. His current H-factor is 26 by Scopus and since 2017 he is also Adjunct Associate Professor at the University Luxembourg. **E-mail:** torsten.bohn@gmx.ch

β-Carotene in Humans – Metabolic Pathway and Bioactivation - from Digestion to Tissue Distribution and Excretion

β-Carotene intake and tissue/blood concentrations have been associated with reduced incidence of chronic diseases. Bioactive derivatives can modulate the expression of genes *via* the nuclear hormone receptors RAR- and RXR-mediated signalling. To better understand the metabolic conversion of β-carotene, interindividual differences in β-carotene bioavailability and bioactivity are key steps that determine its metabolism, bioactivation and mediated signalling. Major carotenoid metabolites, the retinoids, can be stored as esters or oxidised and excreted by phase-2 metabolism. The aim of this review was to highlight the control points that determine the fate of β-carotene in the human body, with a focus on BCO1 (Beta-Carotene Oxygenase 1). The hypothesis that higher dietary β-carotene intake and serum level results in higher β-carotene-mediated signalling is partly questioned, and alternative autoregulatory mechanisms in β-carotene/retinoid-mediated signalling are highlighted to better predict and optimize nutritional strategies involving β-carotene related health benefits.

Dr. Anne Marie MINIHANNE, WG member COST Action POSITIVe

University of East Anglia, UNITED KINGDOM

Prof Anne Marie Minihane, Nutrition and Preventive Medicine Department, Norwich Medical School, University of East Anglia, UK. Anne-Marie Minihane heads the *Nutrigenetics* Group and is the *Director of Research and Innovation*, at Norwich Medical School, at the University of East Anglia (UEA), UK. The group investigates the independent and interactive impact of dietary components (in particular marine n-3 fatty acids and plant bioactives) and *APOE* genotype on cardio-metabolic and cognitive health. Genetic and physiological determinants of dietary component bioavailability and tissue status are also of particular interest. The majority of the work uses randomised controlled trials (RCTs) with the 'human' interventions complemented by cell and rodent studies and molecular biology approaches to inform the RCTs and investigate the mechanisms underlying gene*diet*health associations. In addition, at UEA Anne Marie contributes to the teaching of the Medical and Bioscience students, in the area of nutrition and disease prevention and therapeutics. She is academic advisor to the Nutrient Optimisation Task Force and part of the Scientific Advisory Committee for ILSI Europe and Deputy Editor of the British Journal of Nutrition. **E-mail:** a.minihane@uea.ac.uk

Key determinants of flavonoids metabolism following mixed dietary flavonoid source – COB Study

There is a wide variability in the physiological response to dietary flavonoid intake, likely due to heterogeneity in their absorption, distribution, metabolism and elimination (ADME). Different factors: age, sex, gut microflora and genotype influence these processes. In the COB acute intervention (NCT01922869), healthy UK adults were prospectively recruited based on sex and age (18-35y, 60-77y). After 3 days on a low flavonoid diet, and an overnight fast, participants consumed a mixed meal (cocoa, and freeze dried orange and blackberry) providing 640mg flavan-3-ol, 340mg flavanones and 390mg anthocyanins. Seven blood and five urine samples were collected up to 48h post-test meal. Targeted human sequencing (n=112 genes) and 16s rRNA faecal microbiome analysis was conducted, with 80+ flavonoid metabolites quantified by LCMS. 186 participants completed the trial. Here, the first data from the COB study is presented. It is anticipated that this trial will significantly advance current knowledge on key determinants of dietary flavonoid status and response to increased intake.

Dr. Claudine MANACH – WG1 co-leader COST Action POSITIVe

National Institute for Agricultural Research-INRA, Clermont Ferrand, FRANCE

Dr Claudine Manach is a Principal Investigator at the Human Nutrition Unit of the National Institute for Agricultural Research (INRA) in Clermont-Ferrand, France. She holds a diploma in Biology Engineering and a PhD in Human Nutrition by the University of Auvergne, France (1998). Her research initially focused on the bioavailability of polyphenols. For 12 years she has led national and international projects in nutritional metabolomics with the objectives: 1) to discover new biomarkers of food intake and improve dietary assessment, 2) to better characterize the interindividual variation in true exposure to plant food bioactive metabolites and 3) to identify food metabolome variations in plasma and urine that are associated with diet-related diseases in prospective cohorts. She is leading or contributing to the development of major online resources for nutritional metabolomics (PhytoHub, HMDB 4.0, FoodComEx, Biotransformer). She has been awarded as a Clarivate Highly Cited Researcher in Agricultural Sciences in 2017. **E-mail:** claudine.manach@inra.fr

Untargeted metabolomics for assessment of true exposure to plant food bioactives

Current methods to assess exposure of individuals to plant food bioactives (PFBs) have limitations in coverage and precision. Untargeted metabolomics offers tremendous new possibilities for the analysis of complex profiles of PFBs and derived metabolites in food and biofluids. High-resolution mass spectrometry is the method of choice because of its wide coverage and sensitivity. However, there is a complete lack of standardization of the analytical and data treatment methods and many hurdles still have to be overcome for an efficient identification of all features detected in metabolomics profiles. Several collaborative actions were engaged in the COST POSITIVe to improve tools and methods. A comparison of the analytical coverage of a set of selected PFBs by 13 platforms revealed the current limitations and opportunities for improvement. The sharing of retention time data was organized using the online tool PredRet which provided accurate prediction of retention times for >320 bioactives compounds including rare compounds in the individual chromatographic systems. A major collective effort was also made to enrich the database PhytoHub (http://phytohub.eu/) with food sources and known metabolites of some major PFBs. Such collaborative initiatives are key to make possible the use of metabolomics for assessing true exposure to plant food bioactives and for phenotyping individuals on their capacity to produce specific bioactive metabolites.

Dr. Aleksandra KONIC-RISTIC, WG member COST Action POSITIVe

University of Belgrade, SERBIA - University College Dublin, IRELAND

Dr Konic Ristic is a senior research scientist at the Centre of Research Excellence in Nutrition and Metabolism, University of Belgrade, Serbia. Starting from June 2018, she works with Prof. Eileen Gibney as a Marie Sklodowska-Curie Fellow at the University College Dublin. Aleksandra works in the area of Food and Health for almost 15 years. She received her MSc and DSc in Pharmaceutical Sciences/Food Science and Nutrition from the Faculty of Pharmacy, University of Belgrade, Serbia, and conducted the post-doctoral research in Serbia and UK, at the University of Leeds. Her research is primarily focused on the effects of food bioactives on traditional and novel parameters of cardio-metabolic health. She was a PI or a co-investigator in a number of clinical trials investigating the effects of plant bioactives, with particular interest in developing protocols and methodologies that target the role of particular phenotypes by minimising other effect modifiers. She established a strong network with industrial partners from collaborative projects and acts as a scientific advisor of the Serbian Coeliac Society. She serves also as an external member of two Ethics Committees in Serbia, at the Faculty of Pharmacy and the Institute for Medicinal Plant Research. **E-mail:** sandrakonic@gmail.com

Quality of reporting of clinical trials addressing the inter-individual variation in response to plant bioactives

The quality of the study design and the reporting of data obtained in clinical trials have critical effects on the results of meta-analyses, and although it adds to the complexity of interpretation it should be assessed and addressed accordingly. Assessing the design and reporting quality becomes even more challenging for studies on inter-individual variability. As part of POSITIVe objectives the Think Tank Group (TTG) aimed to create a scoring system as a valid instrument to be used in the assessment of the quality of studies that specifically report on the inter-individual variability in response to plant bioactives. In an initial phase, an extensive list of parameters was proposed to the entire consortium for evaluation and, based on the selection frequency and consistency, the list was further refined and prioritized. The validity of selected parameters to be included as items in the scoring system was evaluated, the items were defined and assigned with the score for different quality levels. The applicability of the scoring system was tested in terms of consistency and effort, and the validity of the instrument was assessed by comparison with the results of simultaneous evaluation using a scale approach. The results of this collaborative TTG project highlighted the aspects of data reporting that require major improvements in future and created the rationale for specific guidelines and tools to for their implementation.

Dr. Ana RODRÍGUEZ MATEOS – WG2 leader COST Action POSITIVe
King's College, London, UNITED KINGDOM

Dr. Rodriguez-Mateos is a Lecturer in Nutrition at the Department of Nutritional Sciences, Faculty of Life Sciences and Medicine of King's College London. She received her PhD and conducted her postdoctoral studies at the Department of Food and Nutritional Sciences of the University of Reading, UK. She then worked as a Research Group Leader at the Division of Cardiology and Vascular Medicine of the University of Dusseldorf in Germany, before joining King's College in 2016. Her research aims to investigate the impact of plant food bioactives on cardiometabolic health, with a strong focus on understanding the bioavailability, metabolism and cardiovascular health benefits of polyphenols. Her expertise includes development and validation of analytical methods for identification and quantification of polyphenols in foods and biological samples and performance of randomized controlled trials with cardiovascular outcomes.
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Investigating variability in cardiometabolic response to plant food bioactives: approaches and main findings from POSITIVe

Accumulating evidence from epidemiological and human intervention studies suggest that consumption of plant food bioactives may reduce the risk of cardiometabolic disease. An increasing number of studies reported substantial between-subject variations in the response, indicating that the consumption of particular bioactives may benefit some individuals more than others. The COST Action POSITIVe aimed to examine the extent of such variability and identify the main factors responsible for it. Our first approach was to conduct meta-analysis of published randomized controlled trials (RCTs) evaluating the impact of different families of bioactives (flavanols, flavonols, anthocyanins, ellagitannins and phytosterols) on selected biomarkers of cardiometabolic risk, such as blood lipids, blood pressure, endothelial function and plasma glucose. Host-related factors such as age, sex or BMI were analysed either through between-subgroups analysis, or as continuous predictors in meta-regression. In a collaborative effort, protocol and templates for conducting meta-analysis within the context of POSITIVe were developed. The findings revealed that factors such as BMI or health status could explain part of the variability, however the results differed depending on the type of bioactive investigated. An important finding of this work is that factors potentially explaining variability are not reported or poorly reported in most of the existing RCTs. Other factors that could affect variability such as the gut microbiome or genetic polymorphisms could not be investigated using this approach. The possibility to access individual raw data from different studies and merge it using data fusion was also explored and optimal study designs for future studies addressing variability were evaluated.

Dr. Dragan MILENKOVIC – WG2 co-leader COST Action POSITIVe

National Institute for Agricultural Research (INRA), Clermont Ferrand, FRANCE

Dr Dragan Milenkovic is senior research scientist at the French Institute of Agricultural Research (INRA, France) and is visiting research scientists at the University of California Davis (Davis, CA, USA). He received his master degree in genetics/bioinformatics and his PhD from University of Versailles (France) in molecular genetics. The aim of his research is identification of molecular and cellular mechanisms underlying vasculo-protective effect of bioactive plant compounds, particularly polyphenols. This research is based on nutrigenomic analyses, as well as studies with animal models of atherosclerosis, clinical trials in humans and in-vitro studies with endothelial cells and polyphenol circulating metabolites. Currently, he is developing projects on the impact of polyphenols on neurovascular function, blood-brain-permeability and systems biology to integrate results from nutrigenomics studies, including epigenetic modifications, gene, miRNA and protein expression as well as in-silico docking studies to evaluate interaction between polyphenols metabolites and cell signalling proteins. **E-mail:** dragan.milenkovic@inra.fr

Evaluation of cell and molecular targets of plant food bioactives: implications for inter-individual variability

Studies aiming to identify mechanisms of action of plant food bioactives underlying their health properties have revealed that these micronutrients can modulate expression of a large number of genes. The aim of this work was to identify global analyses of genomic data available in literature from clinical, preclinical and in-vitro studies, perform global bioinformatics analyses and identify key genes. A comprehensive literature search identified over 1500 publications for flavanols using search words. After screening of these papers, 262 papers were identified as meeting the aim of this study. Genomic data were extracted from these papers and global bioinformatics analyses performed including gene network analyses, pathways, protein-protein interactions and transcription factors involved in the observed genomic effect as well as in-silico docking to predict potential interactions between flavanols and cell signaling proteins. Nearly 350 genes were identified the expression of which was found to be affected by flavanol metabolites in-vivo and in-vitro. These genes are involved in the regulation of insulin signaling, inflammation, fatty acid metabolism or PPARs signaling. Among the 350 genes, 34 of them have been identified as differentially expressed either in at least half of the studies or present key node genes in protein-protein interaction network. Bioinformatics analyses have also identified potential transcription factors and cell signaling proteins involved in the genomic effect of flavanols, such as SP1, PPARg or Nf-kB. On-going docking analyses suggest that flavanol metabolites can interact with cell signaling proteins, presenting potential initial signaling of observed genomic effects. Furthermore, on going analyses showed that these key genes have SNPs, some of which present gene-nutrient interactions or cardiometabolic clinical outcomes. These SNPs could potentially present potential polymorphisms underlying interindividual variability in the health properties of flavanols. In conclusion, this global nutrigenomic analysis identified key molecular mechanisms and key genes involved in the cardiometabolic health properties of plant food bioactives and their potential polymorphisms.

Prof. Francisco TOMÁS BARBERÁN – Co-Chair COST Action POSITIVe
Food Science & Technology, CEBAS-CSIC, Murcia, SPAIN

Research Professor of CSIC (Murcia, Spain). His current research aims to the study of role of food polyphenols in human health, their interaction with gut microbiota and their potential in personalized nutrition. His research has been transferred to industry (6 patents of which 3 have been licensed and derived products are actually in the market). Associate editor of the Journal of Agricultural and Food Chemistry. Author of over 350 publications in scientific journals within the fields of phytochemistry, and food science and nutrition. These articles have been cited over 20000 times (H-index 78). He has developed more than one hundred competitive research projects and contracts with industry.
E-mail: fatomas@cebas.csic.es

Impact of gut microbial metabolism on cardiometabolic markers

Consumption of phytochemicals has been associated with health benefits. The unambiguous determination of these health effects, however, has been difficult to demonstrate. This can be explained by the large inter-individual variability observed after the intake of phytochemicals. In the case of (poly)phenols, some volunteers display a clear biological response while others do not respond after dietary intake. Gut microbiota is one of the key factors behind the inter-individual variability observed after exposure to dietary (poly)phenols. Different metabotypes have been identified after the intake of soy isoflavones, pomegranate ellagitannins, flaxseed lignans and hop isoxanthohumol. Other (poly)phenols can also display significant metabolic differences depending on the gut microbiota composition although they have not been studied in detail so far. Individuals can, therefore, be stratified by their gut microbiota-derived (poly)phenol metabotypes. Equol producer and equol non-producer metabotypes, and urolithin metabotypes A, B and 0 have been reported after the intake of soy isoflavones and ellagitannins/ellagic acid respectively. These metabotypes have different gut microbiota composition and therefore gut microbiota polyphenol metabolites. Hence, different health effects are expected after (poly)phenols exposure. This has been demonstrated in both cases as different effects on cardiometabolic biomarkers have been observed after the intake of soy isoflavones and pomegranate ellagitannins respectively depending on the metabotype. Ellagitannins and ellagic acid are a good example to illustrate the inter-individual variability derived from gut microbiota metabolism. The genera *Gordonibacter* and *Ellagibacter* are now identified as characteristic of urolithin metabotypes A and B respectively. They correlate as well with different cardiometabolic risk biomarkers. Clustering of individuals according to urolithin metabotypes has been demonstrated to explain the inter-individual variability in the improvement of cardiometabolic risk biomarkers (LDL-Cholesterol, ApoB, oxidized cholesterol) in overweight-obese individuals consuming pomegranate. These metabotypes also show differences between healthy, overweight, obese and metabolic syndrome individuals. Stratification of individuals by gut microbiota (poly)phenol derived metabotypes needs to be considered today to understand the effects observed in intervention studies with these phytochemicals. This inter-individual variability has to be explored for different phenolic groups, and the gut bacteria responsible for (poly)phenols catabolism need to be studied. The gut microbiota metabolites are bioactive compounds which are better absorbed than the parent metabolites and persist for a long time in the body and therefore have been suggested as responsible for the biological effects of dietary (poly)phenols. These metabolites, however, can also be considered as biomarkers of the gut microbiota that colonizes the colon, and that has been associated with health effects.

Dr. Emilie COMBET, WG member COST Action POSITIVe

University of Glasgow, UNITED KINGDOM

Emilie is a senior lecturer in human nutrition at the University of Glasgow, Scotland, UK. Her research focuses on the impact of nutrition on health through the lifecycle, with particular interest in the 'farm-to- fork-to-society' nexus, and its implications for all stakeholders, from community, industry and clinical settings. Her group's research is translational and underpinned by a combination of lab-based research and trials in human volunteers. It provides basic knowledge of nutrition and metabolism in the context of biomedical research, but also has a range of applications for industry and provides evidence supporting public health policy making. **E-mail:** Emilie.combetaspray@glasgow.ac.uk

Beyond results - lessons learned from POSITIVe meta analyses

A major drive of the COST POSITIVe WG2 was the preparation and delivery of a suite of meta-analyses focusing on the impact of plant bioactive on cardiometabolic health. Immediate tangible outcomes of these large pieces of work carried out by the consortium are the opportunities for networking and collaboration it fostered, as well as a closer, collaborative appraisal of the quality of the scientific reporting of intervention trials in the field. The three meta-analyses published to date, and the manuscripts in preparation, have highlighted opportunities for food bioactive and health research, but also areas for improvement in the reporting of factors contributing to the assessment of inter-individual variability. This lecture will reflect on the challenges encountered along the way, the lessons we learnt, and opportunities to move forward and implement these in the future, toward better reporting of trial findings and summarising of the literature.

Dr. Eileen GIBNEY, WG2 co-leader COST Action POSITIVe

University College of Dublin, IRELAND

Associate Prof Eileen Gibney (BSc, PhD, MSc) has worked in the area of human nutrition since 1997. Degree in human nutrition, University of Ulster at Coleraine; PhD from the Dunn Nutrition Unit, University of Cambridge in 2001 and MSc in Molecular Medicine (TCD) in 2003. Eileen held post-doctoral positions at the University of Newcastle and Trinity College Dublin, before joining UCD as Lecturer in Nutrition in 2005. Her current research interests lie in the area of personalized nutrition, where she develops strategies and innovative technologies for personalized dietary and lifestyle feedback based on dietary, phenotypic and genetic information of the individual. Deputy Director of the UCD Institute of Food and Health and member of the academic staff for BSc Human Nutrition. Associate Dean of Teaching and Learning within the School of Agriculture and Food Science. In addition, Eileen is a Director of the Irish Association for Clinical Nutrition and Metabolism (IrSPEN) and sits on the Public Health Nutrition sub-committee of the Food Safety Authority of Ireland (FSAI). **E-mail:** eileen.gibney@ucd.ie

Main findings from Food 4Me - Next steps

The Food4me project examined all aspects of Personalised Nutrition; from consumer acceptance, to ethical and legal issues and opportunities of various business models of personalised nutrition. It also conducted one of largest studies to date examining the impact of provision of personalised nutrition on behavioural change. Recruiting over 1600 individuals across 7 European countries, food4me examined whether providing personalized nutrition (PN) advice based on information on individual diet and lifestyle, phenotype and/or genotype would promote larger, more appropriate, and sustained changes in dietary behaviour. Adults from seven European countries were recruited to an internet-delivered intervention and randomized to one of four groups: (i) conventional dietary advice (control) or to PN advice based on: (ii) individual baseline diet; (iii) individual baseline diet plus phenotype (anthropometry and blood biomarkers); or (iv) individual baseline diet plus phenotype plus genotype (five diet-responsive genetic variants). The study aimed to examine changes in dietary intake, anthropometry and blood biomarkers measured at baseline and after 3 and 6 months' intervention. Results demonstrated that the provision of personalized advice resulted in greater improvements in dietary intake in the personalized groups, compared to the control (general healthy eating guidelines) group, but that the level of personalization (level 1, 2 or 3), had no effect. In essence to the participant, or the consumer, personalization of advice was important, but not how that advice was derived. This talk will summarize subsequent detailed analysis of the food4me study, and outline how the findings may influence the development and provision of personalized nutrition offerings.

Dr. Baukje DE ROOS, WG3 leader COST Action POSITIVe

University of Abeerden, UNITED KINGDOM

Baukje de Roos obtained her PhD in Human Nutrition at Wageningen University in January 2000, and worked as a post-doc at the Department of Vascular Biochemistry, Glasgow Royal Infirmary, in collaboration with GlaxoSmithKline. She joined the Rowett Institute in Aberdeen, United Kingdom in 2001, where she is currently the Deputy Director. She has >75 peer-reviewed scientific publications in international high-impact journals, and has given >75 invited oral presentations and keynote lectures at internationally established conferences and meetings. Baukje de Roos is the CEO of the European Nutrigenomics Organisation (NuGO), a network of over 28 Universities and Research Institutes across Europe, focusing on jointly developing the research area of personalised and precision nutrition .In the past 25 years she has executed a large range of human intervention studies, and has applied several relevant ex vivo and in vivo models, to assess the health properties of dietary fatty acids (such as omega-3 fatty acids and conjugated linoleic acids) and bioactive plant polyphenols (such as flavan-3-ols from cocoa and phenolic acids from olives). She assesses the health effects of dietary bioactives by measurement of validated risk markers of cardiovascular disease but increasingly also by measurement of novel health and resilience markers that have been identified through novel nutrigenomics technologies. Her expertise in the area of diet and health has formed the basis of multiple contracts and consultancies with various large food companies (Stephan Nutrition, Cognis, MacPhie of Glenbervie, Provexis, Kelloggs), food levy boards (Seafish), the food and drink support sector (Food and Drink Innovation Service), and national UK television (Channel 4's Food Hospital and Superfoods Series). **E-mail:** b.deroos@abdn.ac.uk

Personalized intervention: a precision approach for the next generation of intervention studies

Diet is a key modifiable risk factor for non-communicable diseases, but increasingly we come to realise that specific diets will benefit some more than others. Indeed, heterogeneity in the responsiveness to bioactive compounds can obscure associations between their intakes and health outcomes in population-based intervention studies. This heterogeneity may be partly due to differences between individuals in the absorption, distribution, metabolism and excretion of compounds, which is often the case for, for example, plant bioactives, but also for bioactive fatty acids. In order to identify the main factors underpinning inter-individual differences in response may help to identify which individuals may particularly benefit from bioactive compounds or dietary patterns. For this we will need to start adapting approaches from pioneering precision medicine studies in an attempt to overcome and indeed benefit from individualised and/or variable response to therapies. This includes the adaptation of n-of-1 clinical trials that focus on the individual, and not average population response to interventions, and the introduction of multiple, or continuous measurements in individuals over a time course. Aggregated results of many n-of-1 trials offer data on how to better treat sub-populations that share genetic and phenotypic factors, amongst others, or the population at large. A key aspect that will be essential for the development of precision nutrition will be the use of nutrigenomic approaches to allow phenotyping at the individual level. A further important aspect in the delivery of precision nutrition is the development and validation of tools to capture the multidimensional nature of diet. This may include high-throughput nutritional metabolomics complementary to more traditional approaches of assessment of dietary intake and nutrient status.

Dr. Kieran TUOHY, WG member COST Action POSITIVe

Fondazione Edmund Mach, Trento, ITALY

Head of Department, Department of Food Quality and Nutrition, Centre for Research and Innovation - Fondazione Edmund Mach, ITALY. I received my PhD from the University of Surrey (UK) in 2000 and later trained as a post-doc with Professor Glenn Gibson, University of Reading. In 2006 I was appointed lecturer (Associate Professor) at the Department of Food Science and Nutrition, University of Reading and now head the Department of Food Quality and Nutrition at Fondazione Edmund Mach, Trento, Italy (http://www.fmach.it/eng/CRI/general-info/organisation/Chief-scientific-office/Food-quality-and-nutrition). My research focuses on diet:microbe interactions in the gut and how they impact on human health and disease risk. I am currently a Visiting Professor at the University of Ulster and co-chair of the ILSI Europe task force on Functional Foods. I act as associate editor responsible for microbiota for the European Journal of Nutrition and the Journal of Functional Foods. I have over 130 international peer reviewed articles in the area of food, nutrition and gut microbiology and a Researcher ID h-index of 37 (G-9142-2011). In 2014, he co-authored the book "Diet-Microbe Interactions in the Gut", Elsevier. **E-mail:** kieran.tuohy@fmach.it

Microbiome variants in relation to bioavailability of plant food bioactives

The human gut is colonized by a complex collection of microorganisms which shows considerable inter-individual variation. It is determined in part by genetics but predominantly by environment, vertical transmission from the mother, early life microbial exposures and through diet. Diet in adulthood and especially the diversity of complex molecules like fibers and polyphenols which reach the colon, are important for supporting species richness and microbe:microbe metabolic interactions like cross-feeding. In turn, the gut microbiota play an important role in nutrient recovery from these food macromolecules which escape digestion in the upper gut and also for converting complex plant polyphenols into bioactive compounds which may then interact with host physiology to mediate health effects. Despite recent breakthroughs in understanding the structure and function of the gut microbiota, the high degree of metabolic redundancy between even distantly related microorganisms within the gut microbiota, suggests that traditional microbial phylogenetic descriptors may not be the most suitable for describing microbiome variants in relation to bioavailability of plant food bioactives. Instead, the notion of metabotypes based on production of particular profiles of metabolites has been suggested as a more informative approach and one which not only provides insight into biomarkers of intake and nutrikinetic processing of complex plant food bioactives but may also provide information on mechanisms of effect and inter-individual variation both in polyphenol metabolism and physiological responses of clinical relevance. This presentation, using examples of polyphenol metabolism of plant based foods, will describe how combining metagenomics, metabolomics and measures of physiological response in human dietary interventions can improve our understanding of diet:microbe interactions in the gut and their role in reducing the risk of chronic diet and age associated disease.

Prof. Rikard LANDBERG, WG1 co-leader COST Action POSITIVe

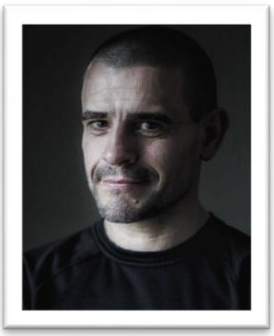
Chalmers University of Technology, Gothenburg, SWEDEN

Rikard Landberg is a professor of Food and Health at Chalmers University of Technology where he is leading the Division Food and Nutrition Science at the Department of Biology and Biological Engineering. His group studies the role of diet and dietary components in health and disease using observational and intervention studies as well as in various model systems. Metabolomics (MS- and NMR- techniques) has become a central point of the research for discovery and validation of exposure and prediction biomarkers, and currently, for molecular phenotyping to discover biomarkers to guide (dietary) intervention individualization strategies. The group is engaged in several large national and international cohort studies and infrastructures where they generate metabolomics data from thousands of individuals to address different research questions in nutrition and medicine. RL is also the principle investigator of randomized controlled trials to evaluate health effects of fiber-rich foods in a precision nutrition approach. Rikard Landberg is affiliated Professor at the Department of Public Health and Clinical Medicine at Umeå University and a visiting scientist at Danish Cancer Society Research Center in Copenhagen and at the Nutritional Epidemiology Unit at the Institute of Environmental Medicine, Karolinska Institutet. His research has led to 105 scientific publications up to date. **E-mail:** rikard.landberg@chalmers.se

New personalized strategies for optimal metabolic responses to fibre-rich foods

A poor diet and lack of physical activity are major risk factors for non-communicable diseases (NCD). Most population strategies to reduce NCD burden have used public health recommendations which are based on “one size fits all”, including recommendations on whole grains. The raise in NCDs worldwide, calls for more efficient prevention strategies. Whole grain foods represent a food group that has consistently been associated with lower risk of several NCDs in observational studies but results on intermediate endpoints in feeding trials have been more inconsistent, possibly due to the presence of responders and non-responders and that study designs have not taken this into account. Personalized nutrition, or precision nutrition, aims to provide customized dietary advice tailored to the individual for optimal health. Gut microbiota and its activity reflected in metabolome have recently gained attention as a target for personalized nutrition strategies. Several studies, but not all, have shown that gut microbiota composition at base-line affect the variation in postprandial glucose responses and long-term weight-loss in humans consuming high-fibre cereal diets. In a recent 8-wk cross-over intervention with lignan-rich whole grain rye vs whole grain wheat, among men with metabolic syndrome, we found significantly lower plasma LDL-cholesterol concentrations after whole grain rye intake compared with whole grain wheat intake ($P<0.05$). For the first time, we showed that this effect was dependent on the pre-treatment Prevotella-to-Bacteroides ratio in fecal samples. This provides support to emerging evidence that gut microbiota affects blood lipids in humans, and some suggested mechanisms will be discussed. Moreover, the potential of applying fecal and/or plasma metabolomics profiling to reflect gut microbiota composition and activity and for metabotyping will be discussed and exemplified with novel data from our lab. This opens up the possibility of using metabolomics for development of optimal dietary strategies in personalized nutrition.

Dr. Paul FRANKS
University of Lund, SWEDEN



I trained at the *University of Cambridge* and the *Phoenix Diabetes Epidemiology and Clinical Research Branch*, NIDDK/NIH. My key works from this period include seminal research on early life programming events and later cardiometabolic health (**Franks PW et al. *NEJM*, 2010**). My subsequent research has focused on the interplay of genetic variation, pharmacotherapy and lifestyle in type 2 diabetes and cardiovascular disease (summarized in: **Franks & McCarthy, *Science*, 2016**). I am now primarily interested in precision diabetes medicine, with special emphasis on lifestyle interventions (summarized in: **Fitipaldi et al., *Diabetes*, 2018**). Much of my current research involves public-private partnerships. I am a professor and Deputy Director of *Lund University Diabetes Center* in Sweden, where I head the *Genetic & Molecular Epidemiology Unit*. Since 2010, I have been on faculty at Harvard University (adjunct professor) and I am a visiting professor at the University of Oxford. In 2018, I was appointed co-chair of the *American Diabetes Association Precision Medicine in Diabetes Taskforce*. I also had a key role in the formation and leadership of the *Nordic Precision Medicine Initiative*. I have authored ~350 papers (cited ~35,000 times), delivered ~150 invited lectures, and I have an H-index ~80. **E-mail:** paul.franks@med.lu.se

Lifestyle in the context of precision medicine

In my talk I will overview the evidence and barriers facing the development and implementation of precision lifestyle medicine in cardiometabolic disease. The detailed characterization of human biology and lifestyle behaviors is now possible at scale owing to innovations in biomarker, bioimaging, and wearable technologies; 'big data' from electronic medical records, health insurance databases and other platforms is also becoming increasingly accessible, and computational power and bioinformatics methods are evolving rapidly. Collectively, these advances are creating unprecedented opportunities to better understanding the role lifestyle plays in cardiometabolic disease. Identifying hidden structures within these complex datasets and linking these structures to outcome data may yield unique insights into the risk factors and natural history of disease, which may in turn help optimize disease prevention and management. This emerging area is broadly termed 'precision medicine'.

Prof. Wim VERBEKE

University of Ghent, BELGIUM

Wim Verbeke is professor of agro-food marketing and consumer behaviour at Ghent University in Belgium. Wim has a combined background in natural (MSc Bio-science Engineering: Agricultural sciences; PhD Applied Biological Sciences) and social sciences (MBA Marketing Management). His teaching and research are in the field of economics, food marketing and consumer behaviour, and food policy. His research focuses on food consumer science, stakeholder and consumer decision-making, perception and acceptance of production technologies and food products or product concepts. Wim has (co-)authored more than 250 peer-reviewed papers in leading international journals in the disciplines of agricultural economics and policy, agriculture, marketing, communication, food science and technology, and nutrition and dietetics. He has been awarded as a Clarivate Highly Cited Researcher in Agricultural Sciences for three consecutive years since 2015.

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Personal determinants of consumers' healthy and sustainable food choices

This presentation will focus on the consumer perspective and discuss the role of health and sustainability as drivers of food choice while accounting for diversity in terms of personal characteristics, attitudes, interests and motivations. Findings from multiple consumer studies will be shared. These range from the mapping of consumer perceptions and attitudes, over the perceived importance of health and sustainability relative to other food product attributes, to purchase intentions and behaviour. The latter will also cover willingness-to-pay for foods with a health and sustainability benefit. I will demonstrate that the concepts of health and sustainability match very well for large majority of consumers, while about one third is also strongly interest in both concepts. The finding that personal motivation matters more than ability for consumers to make healthy and sustainable food choices, and the potential of a positioning that is based on health and sustainability combined, will be presented. Favourable attitudes towards health and sustainability do not systematically translate into according behaviours. I will illustrate the citizen-attitude-to-consumer-behaviour gap, providing insight into why individual consumers may not consistently act in line with their attitude as a citizen. Finally, implications and challenges for policy and communication will be discussed.

Dr. Pascale FANCA BERTHON

Head of Nutrition & Health Science, Naturex, FRANCE

Ph.D. in Physiology and Nutrition (2009). Joined Naturex as a scientific coordinator in 2013 and at present, she is the Head of Nutrition & Health Science and responsible for the implementation and coordination of a global research program that develops and investigates an extensive portfolio of botanical extracts for the food, nutraceutical, and pharmaceutical industries in relation to their health benefits. Main responsibilities include the design and monitoring of protocols and preclinical and clinical research, writing reports and scientific articles, supporting the technical development of plant extracts to expand the portfolio of products, scientific evaluation of companies in order to make mergers and acquisitions, preparation of product registration and health claim applications, public and private collaborations, National or European project partner representative.

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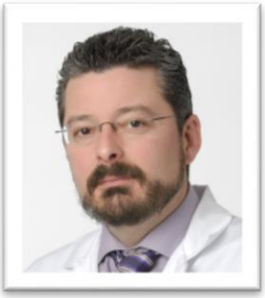
From science to market: challenges of personalized nutrition with botanicals

Phytochemicals coming from food or food supplements are differentially absorbed, distributed and metabolized by the host and the gut microbiota leading to high inter-individual variability in their health properties. This justifies the relevance of trying to implement personalized recommendations for people consuming food or food supplements and expecting a benefit. By taking several examples of botanicals containing different bioactive compounds and how they exert their activities in humans, we will explore why it is a challenge to push this strategy on the market and what are the limitations and tools still needed to make it real. Current available options on the market and their applicability to botanicals will also be discussed.

Dr. Carlos Javier GONZÁLEZ NAVARRO

Director of Innovation, Centre for Nutrition Research, University of Navarra, Spain



PhD in Pharmacy, Genetics Department, University of Navarra, Spain (1997). He has participated in more than 60 I+D+i national projects and in 12 international projects and is co-author of 8 patents and 30 research publications. He was Director of the I+D+i of the National Centre of Food Technology and Safety (CNTA, till 2012) and of the Bioactive Compounds Section of the Nutrition Research Centre (till 2017). At present, he is the Director of the Innovation Centre of Nutrition Research and member of the Group Nutridynamics and Bioactives in Metabolic Syndrome (University of Navarra, since 2013) and President of the Food and Health Group od the Spanish Technological Platform 'Food for Life'. **E-mail:** cgnavarro@unav.es

Food innovation and personalized nutrition: What is (Spanish) industry demanding from scientists and technologists

Although R&D investment in the food industry has traditionally been lower compared to other sectors, health has become one of the main drivers of innovation in food industry accordingly with the growing concern that exists in society for the impact of food on health and the possibility of improving health through the diet. In this sense, the increasing scientific knowledge regarding this influence of diet (e.g. *via* the impact on gut microbiota) and the greater availability of advanced tools at increasingly affordable costs (e.g. genomics, proteomics or metabolomics) is driving food innovation to more complex approaches, arising new challenges for both industry and scientists and technologists.

Dr. Marjan van ERK

TNO, THE NETHERLANDS

Marjan van Erk works as a senior project manager at TNO and leads multiple complex, multidisciplinary projects/programs in the area of personalised health. She currently leads the public-private partnership Personalised Nutrition and Health (PNH; https://www.personalisednutritionandhealth.com), TNO's activities in the Netherlands Innovation Center for Lifestyle Medicine (www.nilg.eu) and TNO's internal research program on Personalised Health. She has a solid scientific background in nutritional science. She is an experienced and certified project manager (IPMA-C level). She has experience in project management of EU projects (Bioclaims, Food4Me, MissionT2D, NuGO) and was the coordinating project manager of FP7 project NutriTech. **E-mail:** marjan.varnek@tno.nl

Technologies and knowledge for tailored, scientifically grounded products and services in personalized nutrition.

The Personalised Nutrition and Health Consortium is a public-private partnership initiated by TNO and Wageningen University & Research that envisions a society in which every individual is ready and able to make a conscious choice to adopt an eating pattern precisely attuned to his or her needs. In the consortium, the research institutes partner with ~12 SME and companies and expertise in nutritional science, ICT/data science and behavioral science is integrated. The multidisciplinary consortium is researching the technology and knowledge needed to make personalised food and health advice possible on a large scale. Consumers would then be able to decide for themselves what is healthy for them, while companies can add new value and help society to become a little healthier. In this talk I will give you insights into the research performed in the first 2 years of this applied research program, covering technology and knowledge development as well as the pilot studies conducted in real-life setting.

Dr Adrian HODGSON
Nutrition Innovation Consultant, SPOON-GURU, United Kingdom-USA

Dr Adrian Hodgson is an experienced nutritionist specialising in helping people and businesses make better food decisions more often. His work to date has bridged the gap between nutrition science, practical application and business strategy. He trained at the University of Birmingham, completing his PhD and postdoc academic research into the effects of macronutrients, micronutrients and polyphenols on substrate metabolism, physical performance and metabolic health. He has published 15 peer reviewed papers and co-authored a number of nutrition books, as well as having access to a large global network of academics for collaborations. Using his knowledge in nutrition research he has applied it to business with a proven track record of delivering successful nutrition innovation with PepsiCo, Glanbia, Lucozade Ribena Suntory as well as startup businesses such as Spoon Guru and Real Kombucha to name a few. Adrian specialises in applying design thinking methodologies, with a specific focus on consumer centric design to deliver successful solutions to consumer and public health nutrition challenges. Adrian currently helps shape nutrition science and innovation for Spoon Guru. **E-mail:** adrian@spoon.guru

Artificial intelligence, machine learning and precision nutrition are transforming the way people eat and drink

With sixty four percent of the world's population now actively excluding foodstuffs from their diet, the food industry is under mounting pressure to meet a growing consumer demand for tailored food choices. Personalising nutrition to meet people's precise dietary requirements (allergies, intolerances, cost, ease to cook and prepare) and health goals is complex. People use mobile applications in the hope of personalising nutrition. The integration of machine learning (ML) capabilities, beyond mobile apps, stands to deliver significant progress in the field of personalised nutrition and health behaviour change. However, a critical consideration is the paramount importance that these innovations are evidence based, appropriately validated and deliver proven efficacy. Spoon Guru is a London-based technology startup that has developed a unique food search & discovery engine to cater for individuals with multiple or complex search requirements. The Spoon Guru TAGS™ platform enables people and food businesses to deliver a personalised experience tailored to each person, based on their unique dietary needs – increasing the choice of foods available, whilst minimising the effort to find them. It does this by combining AI, machine learning and nutritional domain expertise, enabling large and unstructured data sets to be easily searched and accurately filtered to deliver relevant choices. In this presentation we will discuss how technologies like Spoon Guru can be applied to truly delivery precise nutrition, how food retailers are applying it in practice and thepotential health improvements this sort of technology can deliver.

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