Noémi NEMES

	Food and Agriculture Organization of the United Nations **Italy**

ABSTRACT
PERSPECTIVES OF ORGANIC AGRICULTURE AND SUSTAINABILITY IN 2050

TOPIC: Future of Sustainable Agriculture

Ben VAN OMMEN

	**TNO** **The Netherlands**

BIOGRAPHY
Ben van Ommen is Principal Scientist and TNO (the Dutch organisation for Applied Scientific Research), director of the TNO systems biology program, and director of NuGO, the Nutrigenomics Organisation.
His research applies systems biology to metabolic health and metabolic disease, focusing on understanding all relevant processes involved in maintaining optimal health and causing specific disease sub-phenotypes, developing new biomarker concepts and personalized health treatment strategies.

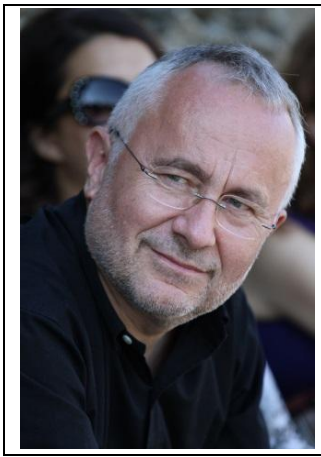
ABSTRACT
NUTRITION AND HEALTH – CHALLENGES AND GAPS IN RESEARCH METHODOLOGY
B. van Ommen

Metabolic homeostasis (and thus health) is determined by the adaptability and reversibility of many processes and mechanisms, like insulin mediated glucose regulation, muscle metabolic flexibility, optimal inflammatory balance, triglyceride metabolic regulation, oxidative stress regulation, HPA mediated stress response, etc. This concept of flexibility (or adaptation, robustness, elasticity, resilience, stress response) appears to be rather universally present as a basis for optimal

performance, health, even survival. Interestingly, diet both plays the “bad guy” (energy overload) and the “good guy”, providing essential factors for many of these processes.
Daily meals provide energy pulses which are efficiently absorbed by multiple processes and mechanisms, and likely negative side effects (like oxidative and inflammatory stress responses) are ideally quenched by counteracting mechanisms. Other external stressors, ranging from bacterial infections to mental stress, trigger comparable stress responses that adapt molecular physiological mechanisms to regain homeostasis. In general, chronic stressors may go beyond the limits of phenotypic flexibility and thereby induce inflexibility, which in turn promotes disease onset.
Interestingly, diet does act on both sides of the balance. On one hand certain nutrients, by excess of by defect, challenge phenotypic flexibility. On the other hand most nutrients, when consumed appropriately, play key roles in the mechanisms maintaining phenotypic flexibility. Understanding the role of nutrients in optimizing each link (organ, process) in the system of phenotypic flexibility may be the best strategy for (personalized) prevention of obesity-related and other nutritional disorders. A new generation of biomarkers will emerge from the application of this concept in a range of physiologically (and psychologically?) relevant processes. I will discuss the concept, mechanisms, consequences and relation with diet of phenotypic flexibility.

TOPIC: Systemic View on Food and Health

Wolfgang KNEIFEL



University of Natural Resources and Life Sciences (BOKU) Austria

BIOGRAPHY
Prof. Wolfgang Kneifel (Full Professor, Dr., Dipl.Ing.) is Head of the Department of Food Science and Technology and group leader of the Food Quality Assurance and Food Safety laboratory. He holds several memberships in scientific associations, like Austrian Association of Food Scientists and Biotechnologists (president), GfM - Society of Milk Science (past president), German Society of Mucosal Immunology and Microbiome (founding member) to be mentioned as examples.
Visiting professorships: Ain Shams University, Cairo, Egypt; University of Hong Kong (School of Biological Sciences). Since January 2012 he also has the function of heading the “Christian Doppler Research Laboratory for Innovative Bran Biorefinery”.
Expertise:
Food safety, food hygiene, product development, optimisation and quality assurance of foods, quality management, food side product valorisation, functional food, pro- and prebiotic research, microbiological quality factors of food and pharmaceutical products, food-GI tract interactions, validation of microbiological analytic methods, development and standardisation of improved

analytical tools, dairy hygiene; EU projects involved with own research teams: COMIDAIRY (FWP4), PROBIOTICS (FWP5), ACE ART (FWP6) , GABRIEL (FWP6), MONIQA (FWP6), HEALTHGRAIN (FWP6), FAHRE (FWP7), SALUS (EAHC, 2011); > 250 scientific publications. Receiving editor in FEMS Microbiology Letters, Editorial Board memberships in LWT Food Science Technology and other journals; reviewer in numerous scientific SCI journals.

ABSTRACT
FOOD QUALITY, VERSATILITY, NEEDS AND EXPECTATIONS
W. Kneifel

Due to a multitude of factors and also owing to regional as well as global developments, food quality has increasingly become a topic of complexity and diversity. Furthermore, outbreaks of food- and feed-borne diseases and related crises, mass production, criminal fraud, nuclear incidents, but also, for example, changing trends in nutrition and consumer food habits, globalisation of food trade have stimulated public interest in food quality and safety issues in general.
According to above described reasons, consumers are getting more and more concerned about food quality although they, on average and compared to earlier times, spend steadily decreasing proportions of their regular budget for purchasing food products and daily nutrition. In terms of information about food, consumers can be regarded as both target and primary driving source, and every kind of information is being fed into a rather inscrutable communication network consisting of public and social media. Today, internationally linked surveillance and alert networks established based on official regulations aim at protecting national markets from contaminated or unhealthy food, and the transfer of messages via modern IT systems, in general, promotes elevated communication, also in terms of various issues of food quality. However, the so-called informed consumer is not always an educated consumer, as he often lacks sound information and specific knowledge. Hence consumer perception on food quality is rather based on relatively illogical issues and on individual gut feeling than on proven facts. Being aware that the area of food quality includes several important sub-categories such as health and nutrition aspects, pleasure, entertainment and also criteria of ethnic relevance, food safety and related risks are considered as the major issues. In this lecture, the diversity of criteria will be illuminated from different perspectives and illustrated according to historical and current trends. Special emphasis will be given on food safety criteria and related constraints and needs.

TOPIC: New Methods for Food Quality Determination

Sören HUSTED

University of Copenhagen
Denmark

BIOGRAPHY

DATE OF BIRTH: April 3, 1963 (Ringkøbing, DK).

MARRITAL STATUS: Married to Anne Skriver, PhD, Vice President, Chr Hansen A/S.

Children (Laura and Markus; 19 and 15 years old).

ACADEMIC DEGREES: 1991: M.Sc in Agronomy, The Royal Veterinary and Agricultural University (KVL), DK; 1997: Ph.D. in Plant Nutritional Physiology and Analytical Chemistry (KVL) EMPLOYMENT: From 1991 to 1993: Research Associate at the Danish Institute of Agricultural Sciences; From 1993 to 1997: Ph.D. student at the Plant Nutrition Laboratory (KVL); From 1997 to 2001: Assistant Professor at the Plant Nutrition Laboratory (KVL); From March 2000 to October 2000: Visiting Scientist at University of Western Australia; April 2001 to April 2010: Associate Professor at the Plant Nutrition Laboratory (KVL); Since May 2010: Professor in Plant Nutrients, Copenhagen University, Life Science Faculty.

RESEARCH PROFILE: Since May 2010: Professor in Plant Nutrients, Copenhagen University, Life Science Faculty. My research is focusing on the functional roles of trace elements in plants. Special attention has been given to physiological and biochemical studies of manganese (Mn), iron (Fe), zinc (Zn) and copper (Cu) in plants. During the last 5 years my research group has contributed to a better and more fundamental understanding of Mn in photosystem II and we have characterized new Mn transport proteins in plants. Moreover, my research group has develop a series of novel mass spectrometry based methodologies, which has paved the road for the first detailed biochemical description of the Fe and Zn molecular speciation in isolated tissue types of the cereal grain. Using this technology we have provided experimental evidence showing that the molecular speciation of Fe and Zn is decoupled in the cereal endosperm and a series of new key-ligands have been identified. I have gained major experimental expertise with the use of multi-elemental and stable isotope analysis using Inductively Coupled Plasma Mass spectrometry (ICP-MS) and Isotope Ratio Mass Spectrometry (IR-MS). I have major expertise in hyphenating chromatographic techniques such as HPLC, UPLC, FPLC and IC with ICP-MS, ESI-MS and ESI-TOF-MS. Recently my research group has implemented the first Danish facilities for Laser Ablation (LA) and Laser Induced Breakdown Spectroscopy (LIBS) which allows quantitative analysis and bioimaging of trace elements in plant solid samples. In recent years my research group has extensively used chemometric data analysis techniques to perform data mining of large and complex data matrices.

ABSTRACT

HOW DO WE DETERMINE PLANT QUALITY OF ORGANIC CROPS?

S. Husted and K. H. Laursen

Plants are photoautotrophic organisms being able to synthesize all metabolites and macro-molecules on the basis of light, CO2, H2O and 14 inorganic elements taken up from the soil. As plants are confined to the environment in which they germinate, this means that the plant ionome, metabolome and proteome are heavily influenced by soil mineralogy, climate and not least agricultural management.

Organic plant products within the European Union are produced according to a specific set of regulations, which e.g. implicate that organic plants are cultivated without pesticides and synthetically produced nitrogen (N) fertilizers. In addition, N fertilizers are often used in lower amounts relative to conventional agriculture. Over more than a decade it has been intensively studied whether these marked agronomical differences lead to systematic differences in the chemical composition of plant tissue and whether this has an impact on selected plant quality

attributes. From a theoretical point of view the marked differences in fertilization strategies between organic and conventional agriculture will cause systematic differences in the chemical composition of plants. The differences are expected to be very large when comparing plants representing the extremes of organic and conventional agriculture. Thus, if synthetic fertilizers are used exclusively for conventional plant production and in high amounts relative to organic production based on animal manure, green manures, compost etc., the conventional plants are likely to differ from the organic ones. However, in most cases plants are not produced with such extreme fertilization strategies and differences are often masked by natural variation caused by e.g. geographical locations and growth season and thereby little difference in plant quality is usually observed.

Despite the fact that systematic differences in chemical composition between organic and conventional plants are usually overridden by natural variation it was recently found that the type of N fertilizers is reflected in the isotope ratios of plants and that the isotopic fingerprints are unbiased by geographical locations and growth season. However, the fundamental differences in isotope ratios are supposedly irrelevant regarding plant quality, but have shown to be a strong signature for authentication of organic plants products.

In this lecture we will further explain how the fertilization strategy can affect the underlying biochemical mechanisms controlling the chemical composition of plants and discuss how these are related to organic plant quality. Special attention will be given to N fertilizer forms and quantity, as fertilization generally appears to be the single-most parameter with the strongest impact on metabolism when comparing plants from organic and conventional agricultural systems.

Acknowledgement: The Ministry for Agriculture, Food and Fisheries and CoreOrganic II are acknowledged for providing funding to the organic research projects “OrgTrace” and “AuthenticFood”.

TOPIC: Quality of Food from Organic and Related Systems

Les LEVIDOW

Open University
United Kingdom

BIOGRAPHY

Les Levidow is a Senior Research Fellow at the Open University, UK, where he has been studying agri-food-environmental issues since the late 1980s. His research topics have included: sustainable development, agri-food-energy innovation, agricultural research priorities, governance, European integration, regulatory expertise and the precautionary principle. During 2008-10 he coordinated a project, ‘Cooperative Research on Environmental Problems in Europe’ (CREPE), analysing divergent agendas for a European bioeconomy, and participated in another project, ‘Facilitating Alternative

Agri-Food Networks' (FAAN), both funded by the FP7 'Science in Society' programme. He is a member of the Expert Core Group of Technology Platform Organics. He is co-author of two books: Governing the Transatlantic Conflict over Agricultural Biotechnology: Contending Coalitions, Trade Liberalisation and Standard Setting (Routledge, 2006); and GM Food on Trial: Testing European Democracy (Routledge, 2010). He is also Editor of the journal Science as Culture.

ABSTRACT
OPPORTUNITIES FOR AGROECOLOGY WITHIN THE CAP AND HORIZON 2020
L. Levidow

Agroecology has three main forms – agricultural practices, interdisciplinary knowledges and citizens' support networks. By linking those three forms, promotional efforts can better gain societal support, obtain state funds, expand agroecological practices and enhance farmers' livelihoods. Through short food-supply chains, supported by citizens, farmers can gain more of the value that they add to products and to the wider environment through agroecological practices. Such improvements have already gone beyond organic-certified agriculture and could be extended further, e.g. by organifying conventional agriculture. There are opportunities to promote agroecology within the Common Agricultural Policy (CAP) and Horizon 2020 – the two main components of the EU budget. Understanding tensions within the EU's policy frameworks can help to identify such opportunities.

As an obstacle to agroecology, both CAP and Horizon 2020 are dominated by an agro-industrial productivist model which degrades the natural resource base. This dominant model benefits mainly input suppliers and food processors, while subordinating farmers and cultivation methods accordingly. EU policy acknowledges the consequent environmental harms, while seeking remedies through resource-efficient techno-fixes which promise to increase both productivity and environmental sustainability. Central to this policy framework is the Life Sciences paradigm, redesigning crops (and trees) for higher-value products which can be more readily extracted, e.g. by more readily decomposing cell walls, processing biomass in biorefineries and recomposing substances into novel products. This paradigm has been reinforced by the Europe 2020 strategy, promoting greater resource efficiency through eco-innovation. Despite the dominant EU policy framework, it can accommodate an alternative paradigm exploring and realising the potential of agroecology. Agroecology combines several types of innovation (social, know-how, organisational and technological). This combination can appeal to EU eco-innovation policy and help build wider support networks. Likewise agroecology offers greater resource efficiency by reducing external inputs and recycling resources.

The CAP has profoundly shaped the European agro-food market and its production-distribution methods. Known as the CAP's first pillar, direct farm payments have been subsidising agro-industrial practices and thus environmental degradation. In preparing the post-2013 CAP, the European Commission proposed measures for 'greening' the criteria in the first pillar. But those criteria were significantly weakened by the European Parliament, thus siding with the agro-industrial farm lobby. For the European Agricultural Fund for Rural Development (EAFRD), known as the second pillar, the Commission proposed that member states must guarantee minimum funds for environmentally sustainable measures and organic conversion; these criteria could incentivise agroecological practices, at least implicitly. The second pillar already has been funding some measures favourable to agroecology – e.g. low-external input methods, organic conversion, high-quality food products, synergies between agricultural and energy production, short food-supply chains, etc. These measures could be expanded in response to farmer-citizen alliances at national or regional level,

regardless of the EU-level legislative outcome on the EAFRD. The EU research agenda too has scope for developing agroecological knowledge. Framework Programme 7 has done so implicitly. Examples include research on: waste conversion into energy and biofertiliser; mixed farming methods; nutrient recycling techniques; and peri-urban food networks which can remunerate farmers for agroecological practices. Horizon 2020 includes 'ecological intensification'; this adapts a concept from Technology Platform Organics for enhancing productivity through agroecological methods, without increasing external inputs or conventionalising organic agriculture. This concept resonates with initiatives in some national research programmes; agroecological research will have opportunities at both levels.

TOPIC: The Future of Sustainable Agriculture

Niels HALBERG

International Centre for Research in Organic Food Systems (ICROFS)
Denmark

BIOGRAPHY

Niels Halberg is the director of ICROFS (www.icrofs.org) and thus the program coordinator for the 11 research projects in the 120 Mio. DKK research program "Organic RDD" (2011-2013). He is also the coordinator of the EraNet "CORE Organic" with 25 European partners and theme coordinator in the European Technology Platform "TPorganics". Advisor to the Danish government's organic food Council and member of EGTOP (The EU Commissions standing committee on organic agriculture). Dr. Halberg has more than 15 years of experience in the research and modelling of organic and conventional farming systems including agronomy, economics and resource use and environmental impact and he has been involved in the development of Life Cycle Assessment methods for food chains. He has conducted on-farm research since 1992 and published several papers comparing organic and conventional farming from different perceptions of sustainability.

ABSTRACT

RESEARCHING LINKS BETWEEN SUSTAINABLE AND HEALTHY ORGANIC SYSTEMS

N. Halberg

According to the organic principles and ideas of IFOAM agriculture should sustain and enhance the health of soil, plants and animals. Thus, healthy farming systems rely on preventive measures for securing crop and livestock health rather than use of external inputs e.g. for control of pests and diseases. Historically organic agriculture was motivated by an interest in improving soil health by use of compost and other organic matter as a prerequisite for achieving healthy crops, which again should support healthy animals and humans. The health principle is linked to the ecology principle

because they both build on agro-ecological methods. The EU regulatory principles for organic agriculture include the importance of working with soil fertility, biodiversity, the environment, animal welfare and careful processing.

Sustainability is an additional criterion, which deals with the question of long term impact on the farming system's reproductive capacity and its use and reproduction of resources and ecosystems services it depends on, thus securing the system's functional integrity. In a broader societal perspective farming systems' sustainability is also considered a question of its wider long term environmental and social impact and of economic relations, thus aspects partly included in the fairness principle. Thus, following the organic principles should – in theory – lead to improved sustainability of organic farming systems.

However, there is a large variation in practice between how closely organic farming systems adhere to the health and ecology principles. There is a need to – one the one hand-developing a language to describe and benchmark the relation between principles and practices in order to make better use of the good examples and – on the other hand – improving the knowledge base for the further development of organic farming systems which are more in line with the health and ecology principles and are also on a sustainable pathway. From a research and innovation perspective this could be linked through focusing on developing more robust or resilient farming systems in both a biological and an economic sense. In other words, farms that through their organisation and adaptability have strong resilience to external pressures and changes in the form of e.g. attack by pests and diseases, climate change and market fluctuations. This resilience can be strengthened by technology and knowledge which enhances the preventative capacity and by improving soil health and improved understanding if its importance for crop and livestock health, including the use of molecular techniques.

Based on these initial definitions of the ideas of healthy systems and sustainability the paper will discuss how these aspects needs to – and can – be included in research programs in organic agriculture.

TOPIC: Future of Sustainable Agriculture

Kirsten BRANDT

Newcastle University
United Kingdom

BIOGRAPHY

Kirsten Brandt is senior lecturer at Newcastle University and Degree Programme Director for its BSc Honours Programme in Food & Human Nutrition. Her background is in biochemistry and phytochemistry of horticultural crops, subsequently also encompassing effects on human health. Her

main research interests are to investigate links between food quality, health of humans and animals, agricultural methods and plant chemistry, in particular:

- Research methods to definitively establish cause and effect documentation for foods or food supplements in relation to human health.
- Effects of plant secondary metabolites (natural pesticides) and other natural bioactive plant compounds on humans, in order to verify and improve the beneficial impact of vegetables and other herbs on human health.
- Plant adaptation to low-input conditions regarding product quality (including content of bioactive compounds) and susceptibility to pests and diseases, in order to improve the balance of environmental and economic sustainability in agriculture and horticulture.
- The feedback mechanisms (conditioned taste aversion, nutrient sensing) that ensure innate preference for nutritious, non-toxic food, dependent on the present needs, in humans and other animals.

Kirsten is currently involved in several publicly or commercially funded human intervention studies to investigate a wide range of different potential health outcomes caused by specific foods or diets. She is also responsible for the establishment and implementation of the NU-Food food and consumer research facility established in 2012. NU-Food comprises facilities for food related trials with healthy volunteers, food production, sensory testing and food-related training activities.

ABSTRACT

INFLUENCE OF FARMING SYSTEMS ON PLANT FOOD QUALITY

K. Brandt

The growth and development of a plant is strongly influenced by external factors including availability of nutrients, light, water etc., and this results in predictable differences in the composition of the plants and products harvested from them. Some effects are direct, for example the content of sulphur-containing bioactive compounds such as glucosinolates can depend on the availability of sulphur in the soil. More often effects are more subtle, where a range of different factors influence the growth rate, and the growth rate subsequently affects the allocation of plant resources to different functions in the plant. These effects are due to the plant's ability to adapt to changes in the environment, which have developed during billions of years of evolution, where only the fittest individuals succeeded to pass on their genes to the next generation. This means that understanding of the process of evolution often allows a prediction of how plant composition will be affected by external factors, for example when comparing the quality of crops produced in organic and conventional farming systems.

The principle is that the contents of those compounds that are most valuable for plants with a high growth rate will tend to be high in conventionally grown plants (e.g. chlorophylls, carotenoids), while other compounds (e.g. phenolic acids, tannins) are favoured by the lower maximal growth rates common in organic farming.

In relation to nutritional food quality, the composition of fast-growing plants tends to increase digestibility and high growth rates of the consumer, which is an advantage for consumers/farm animals at risk of malnutrition, and a disadvantage if the risk is obesity. So organically produced plants are particularly beneficial for populations where obesity is a major health risk. The even lower growth rates in subsistence farming (without any nutrient management) lead to yet another range of compositions, sometimes with very low digestibility.

However, the composition is also affected by other factors such as genotype and climate, usually more than the farming system, so to detect the effect of the farming system it is necessary to control for the other factors, for example to test the same genotypes grown in the same climate.
In general the effect of farming system will affect plants in the same way across different genotypes and climates. This means that on a larger scale this effect can be measured by comparing data from a range of different studies, as long as the data are comparable and the calculations appropriate for the types of experimental design that are used. To the extent that a farming system increases the content of a desirable compound, such meta-analyses can be used to estimate how much health benefit may be obtained by using this system.
Another way this knowledge can be used is to identify batches where the plant composition does not match the expectations. These batches are prime suspects for fraud, whether deliberate or inadvertent, and frequent use of plant analysis, in particular testing for certain secondary metabolites, could be a useful tool to support fraud prevention measures.

TOPIC: Quality of Food from Organic and Related Systems

Flavio PAOLETTI

Instituto Nazionale di Ricerca per gli Aglimenti e la Nutrizione (INRAN)
Italy

BIOGRAPHY
Flavio Paoletti works as senior researcher at the Consiglio delle Ricerche e sperimentazione in Agricoltura – Istituto Nazionale di Ricerca per gli Alimenti e la Nutrizione (CRA-exINRAN) in the Food Science Department. After completing his studies on industrial chemistry, he started working at the Food Technology Unit of the National Institute of Nutrition. Currently, he is head of a research program collecting projects aimed to study the nutritional and organoleptic quality of fruit and vegetables as affected by production method, processing and storage. His research focuses on the quality of organic fruit and vegetables and on innovative preservation technologies. He is member of various national commissions and working groups on organic food and founding member of the Italian Network of Research in Organic Farming.

ABSTRACT
INFLUENCE OF PROCESSING ON FOOD QUALITY WITH FOCUS ON ORGANIC FOOD
F. Paoletti

Consumers' demand for fresh, natural products is increasing, yet most of the food products on the market nowadays are processed.

Food processing is the set of the practices used by food and beverage industries to transform raw plant and animal materials into products for consumers. The aims of food processing are to ensure microbiological and chemical safety of foods, adequate nutrient content and bioavailability, and acceptability to the consumer with regard to sensory properties and ease of preparation. Traditional techniques, such as heating, chilling, drying, salting, fermentation, etc. have been used since centuries. For a long time they have been applied empirically; however, after the principles underlying most of these techniques were known and the knowledge about the mechanisms of food quality deterioration has increased, it became feasible to reduce/control the intensity of some treatments (e.g., heat) and/or modify the approach of their application ("hurdle technology" concept), thus making possible to obtain food products having high level of nutritional and organoleptic quality (fresh-like quality characteristics). The duration of storage of these products is achievable through the selection of raw materials with high microbiological and hygienic characteristics, and the control of the conditions these products undergo along the chain (processing, transport, distribution). The widespread of low temperature storage facilities and the use of packaging has made possible this result; however, the energy cost and environmental impact of this kind of processing represent critical points.

An important contribution has come from the technological development: optimization of the conditions of use of the traditional methods, individuation of technological solutions, and introduction of novel technologies. The public concern about the negative impact of the agro-food system on the environment has boosted the development of environmentally sound and resource efficient production methods and processing techniques. Among the former, organic agriculture is the best example. In the organic sector, the use of substances and processing methods that might be misleading regarding the "true nature" of the product and negatively affect the "vital qualities" and the "organic integrity" of the product should be avoided (EC Reg. 834/2007). In the regulation, however, these terms and other such as "careful processing" are not defined, as well as the concrete criteria to select the technologies that can be used in organic food processing are missing. Among the latter, novel technologies such as pulsed electric field, high hydrostatic pressure, etc. seem promising. However, their industrial exploitation has not yet taken place due to their inherent technological limits, and/or high investment costs as well as cost-intensive maintenance, and/or the need of further research.

TOPIC: Quality of Food from Organic and Related Systems

Jana HAJSLOVA

Institute of Chemical Technology (ICT)
Czech Republic

BIOGRAPHY

Prof Jana Hajslova is the head of the Department of Food Analysis and Nutrition, Institute of Chemical Technology, Prague and its Laboratory of Food Quality and Safety.

She is an expert in food chemistry and analysis and published widely more than 175 original papers on organic contaminants and chemical food safety.

Her research team participated in many international and national projects at both research and project management levels, particularly in two projects funded by the EC 5th Framework programme, five projects funded by the EC 6th Framework programme, several COSTs and EEA grant. Currently, she is the ICTP team leader in charge of the scientific and technological aspects of the seven EC FP7 collaborative projects.

Prof Hajslova participates in many international research activities and under her supervision close collaboration with many world-renowned institutions, such as WHO, FAO, USDA and the European Commission's Joint Research Centre has been established.

She is also the Czech Republic delegate to the Cooperation Work Programme: Food, Agriculture and Fisheries, Biotechnology.

As the chairwomen, she had a key input in establishing a series of very reputable international symposia "Recent Advances in Food Analysis" in 2001-2011.

ABSTRACT

FROM SINGLE CONSTITUENTS TO METABOLOMICS IN FOOD QUALITY ANALYSIS

J. Hajšlová and V. Schulzová

Until now, a wide range of laboratory approaches has been employed for control of organic food quality and authenticity. In addition to widely used light isotope measurement based methods, various spectroscopic and/or chromatographic have been traditionally used for quantification of nutritionally important and biologically active single constituents typical for particular food crop. Recently, fingerprinting / profiling strategies have become promising tools for a more comprehensive characterisation of metabolome, a set of low molecular weight (≤ 1500 Da) primary and secondary metabolites occurring in food commodities. It is assumed that not only phenotype of particular living organism but also external factors, including way of farming, may influence characteristic metabolome compositions. High resolution mass spectrometry either coupled with ultra performance liquid chromatography (UPLC) and/or gas chromatography (GC) represent challenging analytical options. To avoid discrimination of some matrix components, minimal or no sample preparation is required prior to instrumental measurement. These requirements are met for instance by solid phase micro extraction (SPME) sampling technique coupled to GC/MS: volatile metabolites fingerprint is collected in sample headspace. Similarly, in last decade introduced, ambient mass spectrometry (AMS) offers a very relevant solution in metabolomics studies. It should be noted, that instead of target analysis of individual ´quality markers´, metabolomics is based on non-target analysis; identification of all compounds occurring in sample metabolome is not necessarily needed in the first phase, the entire data set consisting of instrumental sample ´signals´ is classified by advanced chemometric techniques.

In our most recent research projects, we have implemented a novel approaches based both on SPME-GC/MS and AMS. In the latter case, a unique ionization source Direct Analysis in Real Time (DART) coupled with a high resolution time of flight mass spectrometer (HR-TOFMS) is employed for fast metabolomic fingerprinting / profiling. Several case studies will demonstrate the potential of these novel approaches to examine food origin.

Acknowledgement: This study was carried out within the project MSMT no. 6046137305 supported by the Ministry of Education of the Czech RepublicTOPIC: New Methods for Food Quality Determination

TOPIC: New Methods for Food Quality Determination

Nicolaas BUSSCHER

University of Kassel
Germany

ABSTRACT
FROM CRYSTALS TO PATTERNS IN FOOD QUALITY DETERMINATION
N. Busscher, J. Kahl, A. Ploeger

Food quality determination can either be performed by single compound analysis, fingerprinting profiles of marker compounds, or by analyzing food systemically. Here we present an approach, which uses a complex system as an indicator for systemic properties of food samples in a aqueous solution. The results are patterns, which can be evaluated by different methods. The concept behind the pattern formation is based on structure formation in physics, chemistry and biology.
Structure formation can be explained by different concepts: entropy export, dissipative structure and with some limitations self-organization.
Entropy export is the phenomenon in a thermodynamical “open” system, that the entropy, which is created inside the system can be transported by the system to the outside (Benard Cells, earth, plants, animals and humans are “open” systems with entropy export). A dissipative system is creating an ordered structure while emitting heat (e.g. Crystals, Benard Cells). The precondition for a dissipative structure is an entropy exporting system. In self organization processes e.g. in biology homeostasis and in physics e.g. the behavior of a nano-scale chaotic process which stabilizes on centimeter scale in structures (e.g. Benard cells, dendritic growth) one cannot point to defined factors that steer the system because all is connected, maintaining the form.
With our approach we use an aqueous CuCl2-additive system, which consists of these three concepts. The applied crystallization is not a usual bulk crystallization, but a highly dynamic process called dendritic growth. It starts which a chaotic, self amplifying process, which is limited by the heat- and CuCl2 transport, and is building a tree like structure (the pattern). Crystallization is a dissipative process. The overall design is entropy exporting due to the evaporation of the water in the CuCl2 solution.
An additive (in this case a complex food sample in the form of a juice or an extract) is changing the branching and growth behavior of the dendritic process. We take this influence as the signal,

whereas the dendritic CuCl2 crystallization is regarded as the basic process, enabling the signal to come forth.
The system reacts on several treatments on the food such as fertilization, storage, degradation, heating, fractionation and molecular weight. One of the major differences compared to compound analysis is, that the resulting pattern is a structure. This is of a higher complexity than comparing the geometric primitive of the Benard system to the weight of the used compound.

TOPIC: New Methods for Food Quality Determination

Barbara PIETRUSZKA

Warsaw University of Life Siences
Poland

BIOGRAPHY
Dr. hab. Barbara Pietruszka is a professor at Warsaw University of Life Sciences (WULS-SGGW), Faculty of Human Nutrition and Consumer Sciences.
She studied at Warsaw University, Poland. She graduated with an MSc degree in Biology with a Biochemistry Specialization. She did her postgraduate work in the National Institute of Food and Nutrition in Warsaw, and since 1990 she has been working at Warsaw University of Life Sciences where she obtained her PhD, and then postdoctoral degree (habilitation).
She teaches human nutrition and nutritional epidemiology. Her research activities are related to the assessment of dietary patterns and nutritional status, human nutrition requirements. Special interest is linked to the role of folate in nutrition of different population groups and the influence of selected factors on folate status, the role of food supplements and fortified products in nutrition. She has been involved in several international projects: SENECA, FolateFuncHealth, EURRECA and NuAge, as well as Polish ones: PolStu, PolSenior and other sponsored by Polish Committee on Research.

ABSTRACT
FOOD SUPPLEMENTS AND EFFECT ON HUMAN HEALTH
B. Pietruszka

Food supplements are defined as foodstuff which purpose is to supplement the normal diet with deficient nutrients. They are relatively new products in comparison to traditional food which contain the balanced amount of constituents (as a consequence of evolution). Dietary supplements are concentrated sources of nutrients and usually one dosage can cover the daily human requirements. Epidemiological studies indicate that dietary supplement use is a very common practice all over the world, and depends on many factors (gender, life style, dietary habits etc.). However, despite the wide use of supplements, the effect of such a practice on human health has not been well defined.

The results of epidemiological studies indicate that the risk of the supplement usage is connected with several factors and among them consumer behavior and quality of such products. Consumers often combine dietary supplements and products fortified with the same nutrients, take more than one supplement at the same time, do not follow the manufacturer's instructions. Such behavior causes the risk of overdose of some nutrients with negative health consequences. Although the form of dietary supplements is like medicine (capsules, pastilles, tablets, pills etc.) the quality control is not as strict as for medicines. Some preparations contain contaminants, the amount of nutrients differ from those declared by producers etc. In spite of no demand to collect the information on side effects for dietary supplements there is some information in this area.

There is an agreement that some population groups can benefit from supplement usage. Among them are strict vegetarians, women of child-bearing age, elderly people. The special positive effects are noticed among people at great risk of malnutrition, especially in developing countries (Africa, Asia). There is a question if the supplement usage give the positive effect on human health in industrialized countries, where the reason for supplement usage is often to minimize the risk of chronic diseases such as cancer, cardiovascular diseases and dementia (Parkinson, Alzheimer diseases) etc.

The results of epidemiological studies are not consistent in opinion, whether the high nutrient doses with supplements taken for a long time are safe. Some studies reported that supplement usage can be beneficial for prevention of some diseases and decreases mortality, while the others indicated adverse effects of some nutrients or other related compounds (e.g. β-carotene) in preventing diseases. More and more attention is paid to the conditions of supplement usage (nutritional and health status of users, dosage, duration of the supplement use, number of constituents, lifestyle etc.) that can modify the health effect. Therefore vitamin and mineral supplementation are still under nutrition debate. What is emphasized by nutritionist is that the main source of nutrients should be a “normal” diet.

TOPIC: Systemic View on Food and Health

Denis LAIRON

French National Institute for Agricultural Research (INRA)
France

BIOGRAPHY

Denis LAIRON got a PhD Thesis in biochemistry and has expertise in human nutrition. He is full-time Research Director at INSERM (National Institute of Health and Medical Research). He has been Director of the Joint Research Unit 476 Inserm/1260 Inra/Université de la Méditerranée “Human Nutrition and lipids : bioavailability, metabolism and regulations” at Marseille, France (1998-2007). His expertises are in the field of lipid digestion and metabolism, food quality, gene-diet interaction

and nutrigenetics, Mediterranean diet and cardiovascular diseases, sustainable diet. He hold partnerships in European projects (3 COST actions, PI-LIPGENE, NoE-NUGO). He supervised 19 University Thesis (PhD) and co-authored 195 original papers in peer reviewed top journals and 80 reviews and book chapters. He has been a member of the Editorial Board of the British Journal of Nutrition and Nutrition and Metabolism. He is an expert in French and international panel Committees in nutrition-related domains. Denis Lairon holds the position of Vice-President, and past President, of the French Nutrition Society. He was the Chairman of the scientific committee of 10th FENS European nutrition Conference, Paris, 2007. He acted as the President of the Federation of European Nutrition Societies (FENS), 2007-2011 and is now the Vice-President of the FENS (2012-2015).

ABSTRACT

HEALTHY PROFILES OF ORGANIC PRODUCT CONSUMERS IN A LARGE SAMPLE OF FRENCH ADULTS: FIRST RESULTS FROM THE NUTRINET-SANTÉ COHORT STUDY

D. Lairon [1], F. Szabo [2], P. Galan [2], S. Hercberg [2] and E. Kesse-Guyot[2]

[1] 1Aix-Marseille Université, Joint Research Unit NORT, Human nutrition; Inserm, UMR-S 1062; INRA, UMR- 1260 ; 13005, Marseille, France

[2]Université Paris 13 Sorbonne Paris Cité, UREN (Unité de Recherche en Epidémiologie Nutritionnelle), Inserm, UMR-557; Inra UMR-1125), Cnam, F-93017 Bobigny, France

In the present context of world food insecurity and widespread unhealthy diets, the FAO raised in 2010 a definition of “sustainable diet” to serve as a guideline for appropriate dietary patterns regarding environment, culture, food and nutrient needs, and health. Indeed, a diet based on organic products may better meet the definition of sustainability. While few hundreds studies have compared the nutrient and pesticide contents of organic foods vs conventional ones, very limited comparative studies have been performed in animals, and even less in humans. From a public health point of view, given the number of consumers of organic food is markedly rising, it is crucial to understand and analyze organic-product-related consumer profiles. Until now, only small-scale studies have described the profiles of organic consumers in few countries and very little information is available regarding their actual food and nutrient intakes or diet-related health indicators. Thus, in line with our previous epidemiological and clinical studies on nutrition and health, we aimed for the first time to describe the organic food consumer profiles in a very large cohort.

Design and methods: Consumer attitude and frequency of use of 18 organic (inc. 16 food group) products were assessed thanks to a dedicated questionnaire in 54,311 adult participants in the Nutrinet-Santé cohort (www.etude-nutrinet-sante), a nationwide, web-based survey, dedicated to nutrition and health status in adult volunteers since 2009 in France. Cluster analysis was performed to identify behaviors associated with organic product consumption. Socio-demographic characteristics, food consumption and nutrient intake across clusters were determined. Cross-sectional association with corpulence was estimated using multivariate polytomous logistic regression. Statistical analyses were performed using SAS software.

Results: Five clusters were identified: 3 clusters of non-consumers whose reasons differed (no interest, avoidance or too expensive cost), occasional (OCOP) and regular (RCOP) organic product consumers. RCOP were more highly educated and physically active than other clusters. Overall differences in incomes between the clusters of non-consumers and consumers were not striking. RCOP consumers also exhibited dietary patterns that included more plant foods and less sweet and alcoholic beverages, processed meat or milk. Their nutrient intake profiles (fatty acids, most minerals

and vitamins, fibers) were healthier and they more closely adhered to dietary guidelines and fitted recommended nutrient intakes. In multivariate models (after accounting for confounders, including level of adherence to nutritional guidelines), compared to those not interested in organic products, RCOP participants showed a markedly lower probability of overweight (excluding obesity) (25≤BMI<30) and obesity (BMI≥30): -36% and -62% in men and -42% and -48% in women, respectively (P<0.0001). OCOP participants generally showed intermediate figures for food consumptions, nutrient intakes and overweight/obesity rates.
Conclusions: Regular consumers of organic products exhibit specific socio-demographic characteristics, with a better dietary pattern fitting food-based recommendations. They are markedly less overweight and obese. The observed plant-food-based dietary pattern of organic food consumers, in addition to being closer to the recommended healthy dietary pattern, may also better comply with the sustainable diet concept to minimize the environmental impact. Finally, these findings provide important new insights into organic food consumer profiles, which will be useful for further testing the relationship between organic food intake and health in surveys based on a prospective design such as that of the Nutrinet-Santé Study.

TOPIC: Systemic View on Food and Health

Gerold RAHMANN

JvT Institute
Germany

ABSTRACT

TOO SLOW MOTION OF NEW SCIENTIFIC RESULTS DEMANDS MORE EFFORTS TO DEFINE FOOD QUALITIES WITH NOVEL METHODOLOGIES

G. Rahmann

In the last decade several projects (e.g., QLIF) have shown interest in a comparison of organic and conventional food quality assessments and meta analyses. These studies came to the conclusions that there are advantages or no advantages in consuming organic products. Boths studies suffer in the assessment of only English papers and ignore novel methodologies in food quality analysis. Therefore boths studies are biases and did not help to answer the question of the „real“ food qualities to have healthy diets for humans. FQH has tried to fill these gaps to discuss food qualities with novel methodologies.
The main concern of consumers are the absense of chemical products like pesticides. There is no doubt that the risk of pesticide contamination is less (but not always zero) in organic than in conventional products which, for example, has been shown for 10 years in studies by the public food monitoring agency in Baden Wurttemberg. On the other hand, organic standards can be a risk for

food quality, e.g. dioxins and heavy metals in eggs from free range chicken, meat (e.g., liver from grazing cattle and sheep) or germs in organic fertilized vegetable (e.g., EHEC contamination in organic sprouts in Germany 2011 with 50 deaths). Zoonoses and antibiotic resistant germs can occur in organic animal products. The level seems to be less in organic products due to low antibiotic treatments of poultry, pigs and dairy cattle.

The positive ingredients are difficult to access. Expensive analytical technology and sophisticated methodologies hinder the broad discussion between scientists and stakeholders. Are nutrients and secondary plant ingredients are significantly good for food quality if they are more or less in food products? Omega 3 is proven as positive and does occur more in roughage based diets of ruminants (plus 20 to 50%) compared to concentrate feeding regimes but fish and flax seed oil has much more omega 3 than dairy products. Stress related ingredients like antioxidants are positive but not clear if they are significant always more in organic products. Phenols and flavonids are usually more in organic products but the trend decrease with improved „conventional“ organic systems (e.g., apple juice from orchards have less phenols compared to apples from old varieties, not treated with copper on extensive orchard meadows).

Novel methodologies are crucial for the scientific support of such a food quality development. It has until now not been proven doubtless that organic foods are healthier, or rather that they can be differentiated from conventional products. The main reason are lack of studies and – mainly – lack of clear and proven samples of organic and conventional products. Major food quality research centres are rare in the area of organic food quality research. They have good technologies and methodologies beside good funds (public and private) to development standards without the scope of organic (e.g., profiling techniques). On the other hand the organic food quality centres are developing novel methodologies (e.g., picture making methods) without the discussion with conventional food researchers. The gap of knowledge between organic and conventional is broadening.

There are big differences in production pattern and production qualities between organic and conventional but even more between organic farms and regions. There can be a big overlapping of results between organic and conventional. Average figures are not suitable for assessments and development. The high standard deviations are excellent for system development in organic and conventional.

TOPIC: Quality of Food from Organic and Related Systems

Saskia VAN RUTH

Wageningen University (WUR)
The Netherlands

BIOGRAPHY

Saskia van Ruth heads the business unit Authenticity & Novel Foods at RIKILT Wageningen University and Research centre in the Netherlands since 2012. This post doubles with her position as professor Food Authenticity and Integrity at the Wageningen University. She received her PhD in Food Chemistry from the Wageningen University in 1995 and carried out research on lipid and volatiles chemistry as post-doctoral researcher for Unilever in 1996-1998. From 1998 till 2005 she carried out instrumental flavour research at University College Cork, Ireland and lectured sensory science and related analytical chemistry. Subsequently she joined RIKILT in 2005 and managed the research cluster Authenticity and Nutrients, as well as the research programme Product Composition till 2012. Her research interests concern complex authentication issues with regard to production system (organic, sustainable, halal), geographical origin, processing, ingredients, and typicality (artisanal products) with application of state-of-the-art analytical methodology in combination with chemometrics. She has published 150+ scientific papers, and participated in numerous national, EU and global projects/committees/networks.

ABSTRACT

ORGANIC FOOD AUTHENTICATION – POTENTIAL AND LIMITATIONS

S.M. van Ruth, S. Heenan, E. Capuano, M. Alewijn, and G. van der Veer

In the last decade public interest in the production of foods increased. This aspect was added to the sensory properties of foods, nutritional value and safety which have been on the agenda for a long time. This in turn boosted organic production. Due to higher production costs, organic produce tends to retail at a higher price than their conventional counterparts. As a consequence of the premium price, organic produce is susceptible to fraud. Fair competition between producers and sustained consumer confidence favour organic production. Analytical verification based on intrinsic markers would complement and underpin the certification process. However, this requires more than a simple analytical test.

Traditional analytical strategies for guaranteeing quality and uncovering adulteration have relied on the determination of the amount of a marker compound or compounds in a material and a subsequent comparison of the value(s) obtained with those established for equivalent material. Authentication of organic produce is complex, and depends very much on the product examined. Therefore, although individual isotopes may provide some information, generally it is unlikely that a single marker allows discrimination between organic and conventional produce. More and more fingerprinting approaches have been developed, which take into account a range of intrinsic (naturally present) components in combination with advanced chemometrics. In the presentation an overview of targeted single marker approaches will be provided, e.g. based on isotope ratio analysis, in addition to information on fingerprint techniques. The various techniques will be illustrated with example studies and are discussed in view of their potential and limitations

TOPIC: New Methods for Food Quality Determination

Machteld HUBER

Louis Bolk Institute
The Netherlands

BIOGRAPHY

Machteld Huber (1951), MD, focusses as senior researcher the topics food quality, health and lifestyle at the Louis Bolk Institute in the Netherlands (www.louisbolk.nl). In 2000 she founded with Triodos Bank, EOSTA and more international partners FQH, the International Research Association on Organic Food Quality and Health (FQH), in which she is still board member.

She coordinated for the European Technology Platform Organics (TPO) in Brussels the development of the Strategic Research Agenda and Integrated Action Plan for the Theme 'Food for health and well-being'. She is a member of the Scientific Council for Integrated Sustainable Agriculture and Food in the Netherlands, where she covers issues on food and health.

ABSTRACT

ORGANIC FOOD AND HEALTH – CONCEPTS AND PERSPECTIVES

M. Huber

When asking the public if organic food is healthier, the regular consumers will say they think it is, whereas non-consumers will answer that again and again science found organic not to be healthier. The contribution will be evaluate several recent views and publications, presentations that were made during the Conference, and give an integrated perspective towards the future.

TOPIC: Systemic View on Food and Health