To limit toxicological testing to a reasonable yet informative extent, the establishment of NM grouping approaches is inevitable and research in this area has gained huge interest in the last decade.

Insight into current concepts and approaches for NM grouping is provided, presenting selected examples from various completed, ongoing, and future research projects. For instance, the EU H2020 project NanoReg2 has built the largest EU-based nanosafety database and conducted several case studies on grouping, using well-characterized NMs from the OECD WPMN Sponsorship Programme. The ERANET SIINN project NanoToxClass followed a different concept by specifically applying a multi-omics approach including proteomics, metabolomics and transcriptomics on in vitro and in vivo samples to gain mode of action information. NanoToxClass performed a grouping case study based on a systematically selected panel of SiO2 NM differing in size, surface charge and surface hydrophobicity. The new German BMBF-funded project InnoMat.Life will specifically focus on more challenging material systems such as highly polydisperse materials, and particles with peculiar morphologies or with mixed chemical composition. InnoMat.Life will also investigate different polymer types (e.g. polypropylene, polyurethane and different types of polyamide) and specifically addresses the "carrier hypothesis" by analysing the interaction of the different polymers with a variety of persistent organic pollutants (e.g. heavy metals, PAHs and PCB).

Finally some remaining challenges will be addressed when applying NM grouping for regulatory purposes.

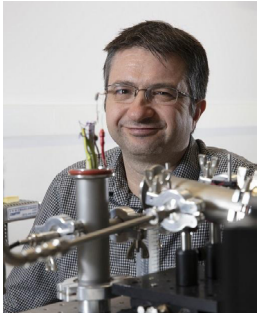
Ralf Greiner

Ralf is Head of the Department of Food Technology and Bioprocess Engineering and Deputy to the President of the Max Rubner-Institut (MRI), Karlsruhe, Germany. His research is focused on studying and modelling conventional and new processing technologies, as well as on food nanotechnology and food application of enzymes especially phytases. His research activities resulted in about 180 original papers in peer-reviewed journals, 55 book chapters and 355 abstracts or short papers in congress proceedings. Ralf is a representative of MRI in several international and national associations on food technology, food control and food nanotechnology. In addition, he is Editor for Food Control (Europe and South America).

Nano-sized delivery systems for food application

Encapsulation can be defined as a process to entrap one substance within another substance, thereby producing particles with diameters of a few nm to a few mm. Recently, the development of engineered nano-sized materials (ENM) produced with food-grade ingredients and designed as delivery systems for organic and inorganic compounds, has gained increased interest. The major reason for this trend is the aim to overcome problems associated with the low bioavailability of many of those compounds which are usually claimed to benefit human health. Such ENM can be produced from single molecules via chemical reactions or by the self-assembly of the individual components. This procedure typically results in the creation of capsules, fibres or tubes that can be used as carrier or delivery systems for smaller molecules. Various lipid, polysaccharide or protein based ENM are already described including e.g. micelles, liposomes or biopolymer particles. In general, ENM designed for the delivery of minerals, secondary plant metabolites and other bioactive compounds have been studied. Experimental evidence for an enhanced bioavailability (up to a factor of 10) of the above mentioned compounds when using ENM was already provided by in vitro as well as in vivo studies. The mechanisms leading to an enhanced bioavailability are based on (i) the chemical stabilisation of the compounds in the gastrointestinal tract (GIT), (ii) their controlled release within the GIT or (iii) an improved transfer of the compounds through the intestinal wall. Particle size, surface properties and the physical state of the ENM are key parameters to be controlled aiming at an enhancement nutritional value of food materials. In addition, such systems must be robust enough to withstand food processing conditions and

environmental changes during distribution and handling by the consumer. However, before nano-sized materials will find wide-spread application in the food sector, information on potential health risks that may arise from their consumption must be available. There are major gaps in knowledge with regard to the behaviour, fate and effects of nano-sized material via the gastro-intestinal route. An important issue for example is whether the nano-sized material is differently digested compared to its individual building blocks. As long as the targeted transport of ENM is not an issue, the uptake of intact ENM may be critical, because the encapsulation might result in an altered tissue and organ distribution with possible negative consequences for human health..



Ken Bosnick

Dr. Ken Bosnick leads the Nanomaterial Depositions and Characterizations Team at the National Research Council's Nanotechnology Research Centre in Edmonton, Canada. His research interests center on inorganic nanomaterial depositions and their applications. Key ongoing projects include developing methods for fabricating sinterable hybrid ceramic structures for applications in armour, exploiting conformal metal coatings for energy harvesting, and synthesizing semiconductor nanostructures for gas sensing applications. He has a keen interest in exploiting nanomaterials to tackle waste issues in the food sector, which will form the basis for his talk at GSRS19..

Nanomaterials for reducing food-related waste

Nanomaterials have a great deal of potential for reducing food-related waste throughout the different stages of the food production system, including through precision agriculture at the farm; spoilage and pathogen sensing for quality assurance at the processing facilities; and food safety and preservation at the consumer stages. This talk will cover our recent advances in the development of amine sensing nanomaterials for the early detection of meat spoilage, as well as how these materials could lead to increased quality assurance and reduced waste in the industry. We will also discuss device strategies we are working on for rapid, point-of-control pathogen sensing that could reduce pathogen detection from the currently needed days to hours. The displacement of petroleum-derived packaging with renewable-derived materials has been hampered by inadequate mechanical performances. We will discuss our work on nanocomposite reinforcement with renewable-derived nanomaterials toward closing this performance gap. Finally, we will discuss our advances on adding smart functionality (e.g. spoilage sensing) to renewable derived packaging materials.

Valérie Fessard

Dr FESSARD Valérie is a toxicologist working for ANSES (France) as the head of the "Toxicology of contaminants" unit. After a PhD in ecotoxicology (1996), she was recruited to develop assays for testing the genotoxicity of contaminants especially the comet assay (both in vitro and in vivo) and the in vitro micronucleus assay. Promoting the 3R rules, she wishes to improve in vitro toxicology testing using high throughput approaches and 3D cell models. She has a long standing experience in the toxicity of marine and freshwater toxins, nanomaterials and mixtures. She has been involved in several European projects and coordinated recently a French/German project on the toxicity of metallic nanoparticles.

Genotoxicity of aluminum nanoparticles

Aluminum is a metallic compound with human concern as it was depicted to cross epithelial barriers and may induce neurotoxicity and embryotoxicity. A tolerable weekly intake of 1 mg/

Global Summit on Regulatory Science 2019

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AGENDA & ABSTRACTS

Optional meetings, training and lab tours on 27 September

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