UNIVERSITY OF OULU

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Sustainable and Healthy Life

Symposium organized by

FINLAND-CHINA
FOOD AND HEALTH NETWORK

on 22nd and 23rd of March, 2023

@F101, Kontinkangas Campus
University of Oulu
Aapistie 7, Oulu 90220
FINLAND

Abstract Book

Table of Contents:

FOREWORD

On behalf of the organizing committee, we are very glad to welcome you to the first ever Finland-China Food and Health Network Symposium on the topic of Sustainable and Healthy Life! at University of Oulu, Kontinkangas campus, F101, Aapistie 7, Oulu 90220 Finland, on 22nd and 23rd March 2023.

The symposium is part of the FCFH network program and focuses on food sciences and food-related health science, especially in sustainability, quality, and health technology related to food as well as nutrition and health effects. The FCFH network connects Finnish Universities and Universities of Applied Sciences and encourages research cooperation with relevant Chinese counterpart.

Please look on the symposium program, and the abstract for the speaker's topic. You can also take part via Zoom link upon registration to the symposium. We are absolutely sure that you will find some interesting topics that match your scientific interests. We invite you to an unforgettable FCFH networking!

Host Organizing Committee

Raman Devarajan, University of Oulu, FI

Kirsi Korpela, University of Turku, FI

Aki Manninen, University of Oulu, FI

Jane Chen, University of Oulu, FI

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Eveliina Aarni, University of Oulu, FI

Katja Nieminen, University of Oulu, FI

Symposium Program

22nd March 2023 (Wednesday): Morning Session

8:00-8:10	Inaguration of the symposium by **Prof Aki Manninen**, FCFH Network core-committee head, University of Oulu
8:10 - 8:20	Welcome words by **Petri Karinen**, Business Oulu, Head of International Affairs
8:20-8:30	Greetings from Rector, **Prof. Taina Pihlajaniemi**, Rector for Research, University of Oulu
Sustainability	Session leader: **Soile Jokipii-Lukkari**
8:30 - 9:00	Plenary talk by **Prof. Riitta Keiski**, University of Oulu, FI. Title: Sustainability assessment and process design in food industry – Separation processes and catalysis for the support of sustainability
9:00 - 9:20	**Prof. Zhang Bolin,** Beijing Forestry University**,** CHN**.** Title: Composition of active components of sea buckthorn harvested in North part of China and their processing for a sustainable development
9:20-9:40	**Dr. Priyanka Trivedi,** University of Oulu**,** FI**.** Title: Natural wax from arctic berries: Composition, morphology and the effect of environmental factors
9:40-10:00	Coffee break
10:00 - 10:20	**Dr. Wenyi Tan,** Nanjing Institute of Technology**,** CHN**.** Title: Electrocatalytic Synthesis Ammonia - A Sustainable Route to Build Nutrition Block
10:20 - 10:40	**Prof. Liwei Pan,** Dalian University, CHN. Title: Integrated Methanation, Fertilization and Zero Emission Technology
10:40 - 11:00	**Dr. Leena Favén,** Centria, University of Applied Sciences, FI**.** Title: Ingredients for health promoting products. Centria`s role between science and business
Nutrition	Session Leader: **Prof. Jane Chen**
11:00 - 11:30	Plenary talk by **Prof. Baoru Yang**, University of Turku, FI. Title: Multi-omics research on effects of berry and potato anthocyanins on sugar metabolism and type 2 diabetes
11:30 - 11:50	**Prof. Seppo Salminen,** University of Turku, FI. Title: The journey from biotics to postbiotics: how to combat definitions and regulatory challenges
11:50 - 12:10	**Dr. Feby Wijaya Pratiwi,** University of Oulu, FI. Title: Enrichment of food-derived nanovesicles using surface-functionalized cellulose nanofibers
12:10 - 13:30	Lunch Break

22nd March 2023 (Wednesday): Afternoon Session

13:30 - 14:00	Funding opportunities on enhancing bilateral collaboration.

23nd March 2023 (Thursday): Morning Session	
8:00 - 8:30	Breakfast
Health	**Session Leader: Aki Manninen**
8:30 - 9:00	Plenary Talk by **Prof. Pasi Kallio**, University of Tampere, FI. Title: Microfluidics and Microsensors for Modular Organ-on-chip Devices
9:00 - 9:20	**Prof. Zong Geng,** Shanghai Institute of Nutrition and Health, CHN**.** Title: Plant-based food components and cardiometabolic health in epidemiological settings
9:20 - 9:40	**Dr. Valeria Iannone**, University of Eastern Finland, FI. Title: Novel microbial therapeutics with dietary change induced metabolic improvements in the liver of NAFLD mouse model
Health	**Session Leader: Jane Chen**
9:40 - 10:00	**Prof. Baojun Xu,** Beijing Normal University-Hong Kong, CHN**.** Title: Wound Healing Effects of Sea Bass (Lateolabrax maculatus) and Their Molecular Mechanisms
10:00 - 10:20	**Prof. Chen Lei,** Guangdong Ocean University, CHN**.** Title: Flavonoid aglycones and their glycosides: which can inhibit the production and toxicity of heterocyclic aromatic amines
10:20 - 10:40	**Prof. Bin Du,** Hebei Normal University of Science and Technology, CHN**.** Title: Ultrasonic Degraded Fucoidan Amelioratd Dextran Sulfate Sodium-induced Ulcerative Colitis by Reshaping Gut Microbiota and Modulating Host-Microbe Tryptophan Metabolism
10:40 11:00	Coffee break
Health	Session Leader: **Prof. Jian-An Huang**
11:00 - 11:20	**Prof. Xia Yang,** Southwest University, CHN**.** Title: Novel SERs strategies for detection of Toxic Substances
11:20 - 11:40	**Prof. Yang Li,** Harbin Medical University, CHN**.** Title: The establishment of a monitoring platform for the concentration of therapeutic drugs in human blood based on surface-enhanced Raman spectroscopy.
11:40 - 12:00	**Prof. Markku Savolainen,** University of Oulu. Title: Digital prevention methods of cardiovascular diseases – Case Onnikka
12:00 - 13:30	Lunch Break

23nd March 2023 (Thursday): Afternoon Session	
13:30 - 14:00	Mid term report: **Kirsi Korpela, FCFH-Co-ordinator**
14:00 - 14:45	Panel discussion: **Discussion leader: Prof. Baoru Yang.** Network collaborations, Business Opportunities and support.
14:45 - 15:00	Closing words by **Prof. Jane Chen**, University of Oulu

Sustainability assessment and process design in food industry – Separation processes and catalysis for the support of sustainability

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ABSTRACT

Lately, sustainable development (SD) has become the cornerstone of environmental policy, and an important driving force for resource management. Sustainability in process design is finding processes that convert raw materials into desired products following the SD goals by the UN's Agenda 2030. Sustainability assessment is a decision-making procedure that helps us in fostering SD and a policy to understand the impacts of our activities. SD is the result of a balance between economic success, social acceptance, and environmental protection, as well as of guaranteeing health and safety of human beings. When assessing sustainability, it is important that all the aspects of sustainability are evaluated when selecting indicators that can be based on, e.g., green chemistry and engineering principles. Taking sustainability requirements into consideration in an early design stage of a process design project is of vital importance.

Today, efforts are being devoted to achieving sustainability in different industries. Moreover, consumer awareness has increased, and consumers request that products are environmentally friendly, and have a well-preserved nutritional content and a high percentage of the domestic content. Sustainable production and design of food products typically focus on several environmental, economic and social aspects. From the economic and environmental point of views that may concern development process intensification and focusing on minimization of emissions and waste, and valorization of by-products, respectively. In the social dimension, the goal can be to provide consumers with safe and health-promoting products.

Separation processes and catalysis play a major role in fostering sustainability in food and chemical industries. These technologies are enhancing materials and energy efficiencies and have several important application areas in food industry. In our case, this has concerned, e.g., concentration of juice by ultrafiltration and reverse osmosis, separation and concentration of aroma compounds by pervaporation, fractionation and demineralization of whey, separation of whey antimicrobial proteins and lactose for e.g., food and pharmaceutical industries.

Microfluidics and Microsensors for Modular Organ-on-chip Devices

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ABSTRACT

Organ-on-chip devices combine tissue engineering with a microfluidic chip-environment that includes different sensing and actuation capabilities enabling long-term cell cultivation and studies. These 2D and 3D on-chip tissue models are expected to enable the construction of dynamic tissue models that perform far better than conventional static cell cultures allowing to recapitulate the way a tissue or part of an organ works. Compared to static cell culture systems, organ-on-chip devices are designed to allow control over concentration gradients, mechanical forces, tissue morphology and cell interactions. The aim is typically to provide minimal functional units that have desired tissue- or organ-level functions.

This presentation will provide a summary of a multitude of microtechnologies developed at Tampere University to compose multi-organ models. The technologies to be introduced include solutions for i) monitoring and controlling the oxygen environment, ii) measuring cellular functionalities using microelectrode arrays and image data, iii) supplying for example drug compounds and changing culture medium, iv) providing different cell cultures substrates from stretching membranes to light-controllable grooves and v) arranging cells in differently connected compartments. Using aforementioned technologies, we have developed various compartmentalized chips to recapitulate a physiological environment and cellular functionality for example in epilepsy, multiple sclerosis, stroke and cardiac ischemia. In addition, the presentation will give an outlook to recently started activities in developing gut-on-chip devices which use photocrosslinkable hydrogels to fabricate novel, reproducible villus scaffolds that mimic the human small intestine.

Multi-omics research on impact of anthocyanins on sugar metabolism and type 2 diabetes

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ABSTRACT

Anthocyanins are widely recognized as bioactive compounds in food, having positive effects on sugar metabolism and energy homeostasis. Anthocyanins from varying food sources differ in structures. Anthocyanins from fruits and berries are mainly non-acylated glycosides of anthocyanidins, whereas dark colored potatoes and vegetables are rich sources of acylated anthocyanins. Acylated anthocyanins differ from their non-acylated counter parts in solubility and stability. While anthocyanins from berries and fruits have been widely studied, less research has been performed to investigate the health effects of acylated anthocyanins. Little systematic data is available for comparing the bioactivities of these two types of anthocyanins. In two clinical studies, purple potatoes rich in acylated anthocyanins and anthocyanin extracts from purple potatoes lowered postprandial glycemic response in healthy male volunteers after a high-carbohydrate meal. A multi-omics approach was applied in a preclinical study to compare the metabolic impact of acylated anthocyanins from purple potatoes with that of non-acylated anthocyanins from bilberries in Zucker diabetic fatty (ZDF) rats as a model of type 2 diabetes. Feeding with bilberry or potato anthocyanins for eight weeks resulted in positive changes in plasma, liver, urine, fecal and cecal metabolites, altered gene expression in the liver and the composition of gut microbiota in ZDF rats. Although both types of anthocyanins modified the energy metabolism of ZDF rats towards the profile of healthy lean rats, acylated anthocyanins from purple potatoes showed regulatory impacts on a wider range of metabolic pathways.

Composition of active components of sea buckthorn harvested in North part of China and their processing for a sustainable development

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Sea buckthorn as a good ecological tree is widely planted in the North part of China for environmental protection. However, a big challenge facing local people is how to make a balance between the environmental improvement and the income increase. It has been documented that sea buckthorn contains a variety of bioactive substances in its fruits, seeds, and leaves. Thus, this work summarizes and analyzes such chemical constituents of sea buckthorn fruit, seed, and leaf as flavonoid, polyphenol, organic acid, soluble sugar, inositol, vitamin, carotenoid, quebrachitol, polysaccharide, mineral element, unsaturated fatty acid, sterol and tocopherol. Its objectives are to provide comprehensive information on the distribution of the active substances for the development of sea buckthorn-based products in food, medicine, and health industries. Of course, local famers and producers need this information to improve their production and management practices before processing sea buckthorn resources for commercialization.

Natural wax from arctic berries: Composition, morphology and the effect of environmental factors

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Keywords: Bilberry, lingonberry, berry press cakes, cuticular wax, triterpenoids, glossy mutants

The outer surface of plants is covered by cuticular wax, which plays a major role in non-stomatal water loss, protection from UV rays and plant defense. We have studied the chemical composition of cuticular wax in bilberry (*Vaccinium myrtillus*), lingonberry (*Vaccinium vitis-idaea*), bog bilberry (*Vaccinium uliginosum*) and crowberry (*Empetrum nigrum*) fruits. Triterpenoids, were found to be dominant compounds in bilberry and lingonberry cuticular wax. Supercritical Fluid Extraction (SFE) was used to extract wax with linoleic acid and γ-linolenic acid as dominant compounds from the industrial leftover of berry (bilberry and lingonberry) juice. Berry waxes show good *in vitro* Sun Protection Factors (SPFs) depicting high UV-B absorbing capacities, suggesting their potential applications in cosmetics. Glossy wax mutants and wildtype bilberry cuticular wax were studied through the course of fruit development. The wax load between mutant and wildtype bilberry was found to be almost similar, however the proportion of triterpenoids was higher; fatty acids, aldehydes and ketones, lower in mutant wax as compared to wildtype bilberry during development. Peel specific expression of wax biosynthetic genes such as *CER26-like*, *FAR2*, *CER3-like*, *LTP*, *MIXTA*, and *BAS* indicates their role in wax biosynthesis in bilberry. While studying the effect of environmental factors on bilberry cuticular wax, we observed that the proportion of triterpenoids increases in as we move from northern latitudes to southern, and correlation analysis suggested temperature to be a major influence. Our study brings new information on composition, moprhology and biosynthesis of berry cuticular wax of as well as utilization of residue of berry juice industry for potential applications in food and cosmetics. The work aims at enhancing bioeconomy, and circular economy, while exploiting potential of side streams of Nordic berry based industry for value added products.

Electrocatalytic Synthesis Ammonia - A Sustainable Route to Build Nutrition Block

Dr. Wenyi Tan

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The world food supply depends heavily on synthetic fertilizer based on ammonia, which is Ammonia is synthesized via the Haber-Bosch process which occurs with N2 and H2 at high temperature (about 500◦C) and high pressure (15–30 MPa), with a low equilibrium conversion of about 15%. On the other hand, NO is a more activated nitrogen source compared with N2 and can be easily reduced, which arouses great attention to synthesize value-added NH3 production. In our group, the state-of-art technology of NO electrochemical reduction reaction (NORR) is first reviewed. And further, the electrolyte, as function as the NO absorbent, is crucial to apply electrochemical technology in practical de-NO engineering. Based on the Brown-ring reaction, the ferrous citrate (FeIICit) was selected as the electrolyte for effective NO absorption. Because the conversion from Fe Ⅱ(NO)Cit to NH3 was a liquid-solid two-phase reaction. The rGO and Au/rGO catalysts served as cathodes to realize ferrous regeneration for continuous NO reduction. The results verified that the reactivation of FeⅢCit was fully achieved by the rGO electrode. After NO saturation pre-treatment, the solvated and coordinated NO could be reduced to NH3 on the Au/rGO electrode in FeIICit solution. At ambient conditions, 14.6 μmol*h-1*cm-2 of the average yield and 65.2% of Faraday efficiency (FE) were obtained and maintained for NH3 synthesis at -0.1 V vs RHE. The effects of different factors on the ammonia yield and selectivity were also investigated. Remarkably, the NORR process was greatly affected by the pH of electrolyte, especially at pH=1.0 with FE(NH3) =98.3%. Therefore, the feasibility of simultaneous NO absorption and NORR processes at ambient conditions was demonstrated, which provided a valuable reference for effective NO adsorption and sustainable NO-to-NH3 conversion.

Integrated Methanation, Fertilization and Zero Emission Technology

Prof. Liwei Pan,

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China is a large agricultural country. It is widely noted that a large number of solid organic wastes are produced in the process of agricultural activities, which cause serious environmental pollution. Based on the results of lab-scale experiments, several pilot-scale tests and demonstration projects were conducted for anaerobic digestion of agriculture solid organic wastes by rumen cultures. IMFZ (Intergrated Methanation, Ferterlization and Zero emission technology) was conducted during this process. The core technology of IMFZ include: 1) rumen microorganisms as inoculum for enhancing comprehensive properties of anaerobic digestion; 2) biogas liquid as ammoniated agent for improving the degradative efficiency of lignocellulose wastes; 3) ecological energy technology for biogas/methane production; 4) ecological composting technology for organic fertilizer. The biogas yield was observed at 420 L/(kgDM) at a dry matter content of 10% (w/w) in an anaerobic reactor with the maize straw and livestock manure as the co-substrate. The volumetric biogas yield, degradation efficiency and methane content were above 1.8 m^3/ (m^3·d), 75% and 60%, respectively. In aerobic composting system, organic matter, humus, total nutrients and water content were 60%, 25%, 10%, 30% and 6.5~8.5. Recently, with the in-depth promotion of China's carbon peak and carbon neutrality policy in agriculture, IMFZ has been successfully applied as a core technology in Xinjiang Province. A new agricultural green recycling industry model was also conducted. With the development of the whole agricultural industry chain, IMFZ will create a better market prospect in improvement of saline-alkali, poor soil quality improvement, improvement of acid soil and high-standard farmland construction.

Ingredients for health promoting products. Centria`s role between science and business

Dr. Leena Favén,

Centria University of Applied Sciences

The need for plant-based health promoting products such as functional food and beverages, food supplements and nutrico cosmetics has been on the rise globally for the past ten years. In addition, COVID-19 has created a strong demand for immune health promoting products.

Many cultivated and wild plants contain valuable compounds such as polyphenols and other antioxidants which have been shown to promote health1. The global botanical industry market size in 2020 was 144,4 billion USD2 and the global polyphenols market size in 2021 was 1,6 billion USD3.

In the Nordic countries there is a need for new knowledge on how local plant-based raw materials could be refined industrially to high value-added products. One of the research and development topics at Centria University of Applied Sciences is extraction and characterization of valuable compounds from biomasses (cultivated, collected wild and industry side streams) in order to support manufacturing of intermediate products, i.e. extracts and powders, which can be utilized by final product manufacturing enterprises. Centria`s chemistry and bio-economy team connects research teams with small and medium size enterprises in order promote the development of bio-based industries. At Centria we have analysed antioxidant capacities and concentrations of polyphenols in plant-based raw materials and in various functional food and beverages which will help our Nordic enterprises to show premium quality of their raw materials and products.

[1] Fraga, C. G., Croft, K. D., Kennedy, D. O. & Tomás-Barberán, F. A., 2019. The effects of polyphenols and other bioactives on human health. Food & Function, Volume 10, pp. 514 -528.
[2] Grand View Research https://www.grandviewresearch.com/industry-analysis/botanical-ingredients-market
[3] Grand View Research https://www.grandviewresearch.com/industry-analysis/polyphenols-market-analysis

Biotic family definitions and future research perspectives

Prof. Seppo Salminen,

FFF, Faculty of Medicine, University of Turku, Finland

Definitions are important for science, regulations and the whole society and therefore the International Scientific Society of Probiotics and Prebiotics (ISAPP) has had a long standing mission of producing science-based definitions for microbiota modulating agents such as probiotics.

The first gut microbiota modulating substances may have been fermented foods. More recent modulators have been named probiotics, prebiotics, synbiotics and postbiotics, but these have not been adequately defined.

Table 1. ISAPP definitions for fermented foods, probiotics, prebiotic, synbiotics and postbiotics.

Fermented food	Foods made through desired microbial growth and enzymatic conversions of food components
Probiotic	Live microorganisms that, when administered in adequate amounts, confer a health benefit on the host
Prebiotic	A substrate that is selectively utilized by host microorganisms conferring a health benefit
Synbiotic	A mixture comprising live microorganisms and substrate(s) selectively utilized by host microorganisms that confers a health benefit on the host
Postbiotic	A Preparation of inanimate microorganisms and/or their components that confers a health benefit on the host

The International Scientific Association for Probiotics and Prebiotics (ISAPP) has convened multidisciplinary panels of experts specializing in nutrition, microbial physiology, gastroenterology, pediatrics, food science and microbiology to review the definition and scope of probiotics, prebiotics, synbiotics and postbiotics as members of the “biotic” family. The panels defined also fermented foods.

There are several current studies intending to develop microbiota modulating foods and provide potentially novel ways for improving overall human health and well-being. Microbiota modifying foods can impact and modulate the structural and functional architecture of an individual’s gut microbial community. They can also provide specific substrates for microbial transformation to biomolecules necessary for a health benefits. Microbiota modifying foods may act through a combination of these mechanisms and also include postbiotic or other biotic components. The development of to expand our view of ‘essential nutrients’ and prompt questions about how they should be classified and regulated.

Enrichment of food-derived nanovesicles using surface-functionalized cellulose nanofibers

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Nanovesicles (NVs) are nanosized membrane-bound particles secreted by various cells and play essential roles in intercellular communication. NVs have been identified in various food sources, including milk, fruits, and vegetables, and have shown potential applications in functional food and pharmaceutical industries. However, the isolation of NVs from food sources remains challenging due to the complexity of the sample matrix. Although ultracentrifugation has been widely used for NV isolation, this has significant limitations, including an extended processing time at high g-force conditions and large sample volume requirements. Here, we will introduce alternative methods based on functionalized cellulose nanofibers (CNFs) to isolate nanovesicles from food resources such as milk and berries, their downstream analysis, and bio application. We will discuss two techniques, cellulose-assisted precipitation and nanocellulose membrane filtration, for NV isolation and application. Nanocellulose-assisted precipitation involves using nanocellulose as a stabilizer for NVs during precipitation combined with short-term and low g-force centrifugation to isolate EVs from different milk fractions. This technique allows the direct proteomic study of isolated NV without the elution process and preservation of the NV's natural properties. In the second approach, the flexible, fibrillar, and entangled network of CNFs form pores, which could selectively entrap the NVs from the sample matrix during the filtration. This technique is used to isolate NV from arctic berries. The isolated NV on the nanocellulose filter possesses an antioxidant effect and improved proliferation of invitro cell culture. Overall, the newly developed technique-based nanocellulose provides straightforward isolation and biocompatibility and preserves the natural properties of the isolated EVs from food sources, enabling further applications.

Plant-based food components and cardiometabolic health in epidemiological settings

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Plant-based diet is known to benefit human and planetary health. In previous studies, we have demonstrated the associations of various components from plant-based food, such as monounsaturated fats, linoleic acids, gluten, and whole grains with diabetes and cardiovascular disease using data from large prospective studies among western populations. We also used nutrient biomarkers to study the associations of fatty acid intake and metabolism with cardiometabolic diseases among Chinese. Because diet is highly complicated in China, accurate assessment of food intake using questionnaire is challenging. Therefore, we aim to develop novel biomarkers for specific food intake combining highly-controlled feeding studies and community-based cohort studies. In intervention studies for common consumed fruits, we collected urine, blood, stool and miRNA sample for biomarker identification, and investigations regarding roles of gut microbiota on the absorption and metabolism of various nutrients and phytochemicals. Samples and data from established cohort studies have also been collected to validate these biomarkers and link them to long-term health of community-dwelling Chinese.

Novel microbial therapeutics with dietary change induced metabolic improvements in the liver of NAFLD mouse model

Valeria Iannone,

University of Eastern Finland, FI

Non-alcoholic fatty liver disease (NAFLD) is the most prevalent liver disease in the world without an approved therapy. This study examined the efficacy of Escherichia coli Nissle 1917 expressing the intestinal hormone aldafermin in combination with dietary change (EcNA) as a potential treatment for NAFLD. NAFLD was first induced in C57BL/6 male mice by American lifestyle-induced obesity diet (ALIOS) and then switched to a standard chow diet for seven weeks. In addition to the dietary change, during these seven weeks, the intervention group received genetically engineered E.coli Nissle 1917 expressing aldafermin, while control groups either received E.coli Nissle 1917 vehicle or no treatment. The efficacy of EcNA intervention was evaluated by measuring NAFLD-related plasma biomarkers, and performing histology, RNA-sequencing, and non-targeted metabolomics in the liver. After the intervention, EcNA reduced body weight, liver steatosis, aspartate aminotransferase (AST), and plasma cholesterol levels. The integration of transcriptomics and non-targeted metabolomics analysis revealed downregulation of amino acid metabolism and its related receptor signaling pathways possibly implicated in the reduction of hepatic steatosis and insulin resistance. Moreover, the downregulation of pathways linked to lipid metabolism and changes in amino acid-related pathways suggested an overall reduction of oxidative stress in the liver. Of note, changes in the metabolites of possible gut-microbial origin were observed suggesting a gut-liver crosstalk.
Conclusions: These results demonstrate the potential efficacy of EcNA in ameliorating insulin resistance, steatosis, and oxidative stress, and thus suggest the potential effect of EcNA in maintaining gut-liver homeostasis.

Wound healing effects of sea bass (Lateolabrax maculatus) and their molecular mechanisms

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Sea bass (Lateolabrax maculatus) has been used for dietary therapy practice for wound healing of puerperal or surgery patients in China. Traditional Chinese medicinal books also documented that sea bass can be used to manage inflammation-associated conditions such as wound, miscarriage and cough. Some studies also proved that dietary supplement with fish benefited for treating many inflammatory – associated conditions, such as cardiovascular disease, ulcerative colitis, and hyperlipidemia. However, the studies on the pharmacological mechanisms of wound healing efficacy of sea bass remain lack of investigation. The aim of this study is to investigate the molecular mechanisms of sea bass on wound healing efficacy. Establishing a further justification for clinical application of aqueous extract of sea bass (ASB) in treating wound healing. Transition from inflammation to proliferation phase treated as the critical step in wound repair which were investigated via in vitro and in vivo study. A series of inflammatory mediators associated with wound healing and proliferation effects of fibroblasts upon treatments were studied via Western blotting, enzyme-linked immunosorbent assay (ELISA), real time reverse transcription- polymerase chain reaction (RT-PCR) and scratch assay. The cutaneous wound model was applied on skin wound healing study to observe the healing process in C57BL/6 mice upon ASB treatments. Hematological parameters and tumor necrosis factor-α (TNF-α) secretions in serum were determined. Histopathological examinations were conducted by hematoxylin and eosin (H&E) staining and Masson staining. Immunofluorescence were performed to identify infiltrating neutrophils (MPO) and α-smooth muscle actin (α-SMA). Results showed that ASB significantly reduced the production of inflammatory mediators (cyclooxygenase-2 (COX-2), nitrite oxide (NO) production and TNF-α). The phosphorylation and nuclear protein levels of transcription factor nuclear factor-κB (NF-κB) in toll-like receptor 4 (TLR4) signaling were decreased by ASB treatment as well. ASB treatments significantly increased wound closure rate and cyclin D1 expression level of fibroblasts. Moreover, cutaneous wound model in C57BL/6 mice presented many similarities in appearance to the process of wound healing. The in vitro study demonstrated an inhibitory effect of ASB on the inflammatory mediators regulated by TLR4 signaling pathways, providing evidence that ASB treatment potentially accelerate the wound healing through migration and proliferation enhancement. Additionally, the in vivo study suggested that ASB treatment has a potential in accelerating the proliferation phase of wound healing via well-organized abundant.

New insight into the effect of hydroxyl substituted flavonoids on the cytotoxicity of heterocyclic amines

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Firstly, eight (8) flavonoids with similar structure including myricetin, rutin, fisetin, quercetin, myricetrin, quercetrin, kaempferol and galangin were co-incubated with 2-amino-4-methylimidazo [4, 5-f] quinolone (IQ) respectively to determine the cytotoxicity in HepG2. The results showed that IQ at low doses showed no cytotoxicity, however, in the presence of myricetin, the cytotoxicity significantly elevated. It seems that C-3', C-4', C-5' and C-5 hydroxyl substituents on the flavonoid skeleton of B ring play important role in the increasing cytotoxicity induced by IQ in HepG2 cells. Secondly, we explored the enhancing effect of myricetin on the toxicity of heterocyclic amine IQ and its mechanism. Under the in vivo conditions, mice did not have toxic reactions after six weeks of intake of myricetin and IQ respectively, however, after six weeks of simultaneous intake of myricetin and IQ in mice, the activity of antioxidant enzymes in mice decreased, the liver and colon were damaged, the level of inflammatory factors increased, and the overall level of fecal short-chain fatty acids decreased. Based on the metabonomics analysis, after mice ingested myricetin and IQ at the same time, the level of tryptophan metabolism and protein digestion and absorption decreased significantly, and the level of uric acid metabolism increased significantly. The intestinal microflora is characterized by a decline in species diversity, and an increase in species abundance of Chlamydomonas at the level of the phylum_ NK4A136_ Group has become the largest dominant strain. In vitro, by studying the effect of myricetin on the rate of IQ uptake by Caco-2 cells, it can be found that myricetin can increase the concentration of IQ entering the cells by acting on P-gp and MRP2 transporters. Similarly, the level of ABC transporter metabolites in mice was significantly increased after consumption of myricetin and IQ. Collectively, the present study provides a potential food matching guidelines for consumers.

Ultrasonic Degraded Fucoidan Amelioratd Dextran Sulfate Sodium-induced Ulcerative Colitis by Reshaping Gut Microbiota and Modulating Host-Microbe Tryptophan Metabolism

Prof. Bin Du

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Scope: The dysbiosis of intestinal microecology plays an important pathogenic role in the development of inflammatory bowel disease. **Methods and Results:** A polysaccharide, named Fuc-S, with molecular weight of 156 kDa, was prepared by the ultrasonic degradation of fucoidan. Monosaccharide composition, FT-IR, methylation and NMR spectral analysis indicated that Fuc-S may have a backbone consisted of →3)-α-L-Fucp-(1→, →4)-α-L-Fucp-(1→ and →3, 4)-α-D-Glcp-(1→. Moreover, the male C57BL/6 mice were fed three cycles of 1.8% dextran sulfate sodium (DSS) for 5 days and then water for 7 day to develop colitis. The longitudinal microbiome alterations using 16S amplicon sequencing was evaluated. In vivo assays showed that Fuc-S significantly improved clinical manifestations, colon shortening, colon injury and colonic inflammatory cell infiltration of DSS-induced chronic colitis in mice. Further studies revealed that these beneficial effects were associated with inhibiting Akt, p-38, ERK and JNK phosphorylation in the colon tissues, regulating the structure and abundance of gut microbiota, and modulating host-microbe tryptophan metabolism of the chronic colitis mice. **Conclusion:** Our data confirmed the presence of glucose in the backbone of fucoidan, and provided useful information that Fuc-S can be applied as an effective functional food and pharmaceutical candidate for IBD treatment.

Novel SERs strategies for detection of Toxic Substances

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Surface-enhanced Raman spectroscopy (SERS) is a sensitive detection tool for toxin substance, biomolecular, which has low background signal, high specificity and simple procedure. However, controlling the gap of Raman hotpots and improving the sensing performance is still a challenge for SERS detection. We proposed a simple strategy to control the gap of the self-assembly nanoparticles on the oil-water interface by using one small molecule. Nextly, we combined CRISPR technology and core-shell Au@PB@Au NPs to construct a ratiometric SERS platform to improve the performance. These novel SERs strategies can achieve sensitively detection of thiram and aflatoxin B1, which have potential for other toxic substances in food.

The establishment of a monitoring platform for the concentration of therapeutic drugs in human blood based on surface-enhanced Raman spectroscopy.

Associate Prof. Yang Li

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Surface enhanced Raman spectroscopy (SERS) is widely used in drug molecular detection. However, SERS detections of drug molecules in serum with high sensitivity and reproducibility remains extremely challenging due to signal interference of complex constituents of serum. The latter presents a high SERS background noise that buries the signals of the drug molecules. Here, we report a 3-step method to make SERS system of silver nanoparticle clusters to overcome the interference and achieve quantitative SERS analysis of drugs in serum by 1) proteins removal from serum; 2) enhanced drug adsorption on the nanoparticles; and 3) background suppression by internal standard in nanoparticle aggregation. By careful selection of the aggregation agents and internal standard, clear SERS peaks of the internal standard and six different drug analytes were observed for pesticide identification in human serum. Significantly, the SERS peak ratio of the internal stardard and drug analytes has achieved univariate quantitative monitoring of drug metabolism in mice serum, which is in agreement with analysis by the multivariate curve resolution-alternating least squares method. Our method shows great clinical application potential in therapeutic drug monitoring and personalized medicine.