Reserved Scholarship

A - EATWELL Investigating oral microbiota signatures related to sensory responsiveness to food: a contribution to understanding food preferences and to promoting EATing habits related to WELLbeing and health

Funding Body:
University of Trento (UniTN – CIBIO)

Supervisor/s
1. Flavia Gasperi (University of Trento)
2. Davide Giacalone (University of Southern Denmark)

Context / Synthetic description of the project and research outcome

Healthy dietary habits during adolescence are crucial to set the foundation for a healthy life. Nevertheless, obesity rates and malnutrition-related issues are still worryingly increasing within adolescent populations, thus raising the urgent need for preventive interventions. Recent evidence has emphasized the influence of dietary habits shaping the oral and gut microbiota, with key implications for maintenance of host health and well-being. Since the individual sensory experience during food and beverage consumption has been consistently reported as playing a strong role on eating habits, research linking oral and gut microbiota with domains of sensory perception has recently gained growing interest. In this vein, the first promising results of the ongoing PhD project “MICROSENS - Understanding the role of human MICRObiota on SENSory perception” (35° ciclo AES, supervisor F. Gasperi in cotutelle with University of Southern Denmark, prof. D.Giacalone) suggest that individual differences in sensory responsiveness to warning sensations (i.e., bitterness and pungency) correspond to changes in the oral and gut microbiota, thus paving the way for unravelling the complex interplay between host-related non-genetic factors and eating behavior.

Despite being a potentially high-impact research line, most of the existing results rely on adults, whereas examples involving individuals in developmental age are still surprisingly rare. More importantly, these reports are based on cross-sectional designs and assessments of sensory perception with poor ecological validity, thus limiting the consistency and generalizability of outcomes.

In the attempt to address these gaps, the main aim of the present PhD project is to find specific signatures in the oral microbiota related to sensory perception of a large cohort of adolescents, to understand their relationships with individual dietary patterns, and to confirm the results for consistency with a longitudinal design. The project here proposed will also benefit of methodologies with high-ecological validity (e.g., tasting actual foods in real contexts), as previously proposed and validated within the MICROSENS project.

The experimental activity will be carried out within the intervention study (200 participants, 14-19 yrs) foreseen in one of the tasks of EU PRIMA project PROMEDLIFE (Novel food products for the PROMotion of MEDiterranean LIFEstyle and healthy diet), led by FEM in collaboration with C3A and planned in 2023: the task aims at demonstrating the efficacy of a free trial food intervention with bioactive-enriched snacks in increasing adherence to a healthy Mediterranean dietary model, implementing an educational intervention based on
nutritional and sensory aspects. For this reason, this PhD proposal can perfectly be integrated into the study and can give great advantages to the resources of the PROMEDLIFE project and the collaboration with the researchers involved.

The research will contribute to the comprehension of sensory related drivers and barriers to healthy eating and well-being in adolescents, to the development of personalized food products according to the individual variability in sensory perception, and to deepen the links between oral microbiota and eating behaviours within this peculiar stage of life.

The PhD student will spend part of his/her training/research in the hosting lab of Research Group of prof D. Giacalone (*) SDU Innovation and Design Engineering, Department of Technology and Innovation, University of Southern Denmark

*D. Giacalone is Associate Professor in Consumer Product Testing and Optimization at the Faculty of Engineering, University of Southern Denmark. His research centers on consumers’ driven product development, primarily within food and other fast moving consumer goods. Special areas of proficiency include methodological research on perceptual product tests with consumers, and the application of sensory methods to product development in research and industry.
### Reserved Scholarship

**B - Numerical modelling of atmospheric transport processes of particulate matter along mountain slopes**

**Funding Body:**
Environmental Agency of the Autonomous Province of Trento (APPA)

**Supervisor/s**
1: Dino Zardi (University of Trento)
2: Gabriele Tonidandel (APPA)

**Context / Synthetic description of the project and research outcome**

Particulate matter, composed either of biogenic or abiogenic substances, play a crucial role in the environment, affecting air quality, atmospheric radiation budgets, propagation of species, ecosystems’ dynamics, human health, and nucleation processes in clouds, and hence precipitation. Transport of such substances over mountainous terrain is made more complicated than over flat areas by the complexity and variety of the wind structures found over mountain slopes. In particular, thermally driven slope winds, often occurring after daytime heating and nighttime cooling of slopes, offer preferred flow patterns, which may variously combine with convection in the upper atmosphere. Also, turbulence associated with these flows plays a crucial role in the uptake, diffusion and deposition of these substances.

The candidate will develop and apply new concepts, derived from recent advances in our understanding of the above winds, to existing mathematical and numerical models, in order to improve their capability of reproducing the above transport processes in a variety of situations. Both Eulerian and Lagrangian approaches will be tested. The latter will include both forward- and back-trajectories.

Comparison with data from field measurements will allow suitable validation of the models.

Cooperation will be pursued with the Environmental Agency of the Autonomous Province of Trento, with the Botany Unit of the Civic Museum in Rovereto, and with the Environmental Botany Unit of the Edmund Mach Foundation.
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<th>Reserved Scholarship</th>
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<td><strong>C - Development of green and real time analytical solutions for the monitoring of bioprocesses of agro-industrial relevance</strong></td>
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**Funding Body:**
*Fondazione Edmund Mach (FEM)*

**Supervisor/s**
1. Franco Biasioli (FEM)
2. Eugenio Aprea (C3A-UNITN)
3. Vittorio Capozzi (CNR-ISPA)

**Context / Synthetic description of the project and research outcome**

This PhD program is in the frame of the I-Next initiative: Sensors, artificial intelligence and digital databases for the monitoring of innovative processes in the food industry, and in food quality.

Fermentation is the food process on which rely the production of a large number of traditional eno-gastronomic products and is being rediscovered as a sustainable biotechnological strategy to improve the quality and safety of agri-food productions. The main theme of the PhD program is the development of a PTR-ToF-MS based set-up as a green and online analytical solution for the rapid monitoring of microbial-based biotechnological processes of interest for the Triveneto region to provide information on the progress of bioprocesses and on the sensorial quality of the final products and for the development of tailored solid state sensors.

The investigated case studies are i) fermentation of alternative proteins from the regional agri-food chains in order to improve sensory acceptance, ii) develop rapid strategies development/monitoring of complex starter cultures for the production of specific fermented traditional products and iii) development of innovative fermented beverages for specific segment of the population.

Collaboration with national and international partner (Foggia University, CNR-IMEM, Otago University) will offer the candidate with the optimal background for training and scientific output.
**PhD in AGRIFOOD AND ENVIRONMENTAL SCIENCES - CALL 2022 – CYCLE 38**

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<td><strong>D - Compound Specific Isotope Analysis (CSI Analysis)</strong></td>
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**Funding Body:**
Fondazione Edmund Mach (FEM)

**Supervisor/s**
1. Luana Bontempo (FEM)
2. Dr. Roberto Larcher (FEM)

**Context / Synthetic description of the project and research outcome**

In recent years, control bodies, legislators and consumers have become increasingly aware of the problems related to food frauds that lead to a substantial negative economic impact and expose consumers to potential health and safety risks. Due to the increasingly widespread circulation of food products around the world, 'paper' traceability is no longer sufficient. It is necessary to develop analytical methods capable of objectively determining whether what is declared on the label is true or not.

Among the analytical techniques already well known to be effective for traceability and verification of authenticity in the agro-food field, there is the determination of the stable isotope ratios of the bioelements (hydrogen, carbon, nitrogen, oxygen, sulfur) by Isotope Ratio Mass Spectrometry (IRMS). Indeed, these parameters, are influenced by factors such as the pedological and geo-climatic characteristics of the place of origin, the botanical species, the diet in the case of animal derived products and the production process in general.

The main objective of this project is the development of new analytical approaches for the authentication and traceability of premium products of high value using hyphenated methods, specifically GC-IRMS (Gas Chromatography - Isotope Ratio Mass Spectrometry) and LC-IRMS (Liquid Chromatography - Isotope Ratio Mass Spectrometry) to directly determine the isotope ratios in specific compounds derived from the product itself (CSIA, Compound Specific Isotopic Analysis). In fact, this approach is often more effective than traditional 'bulk' isotopic methods in which the isotopic ratios are determined on the sample as it is or on specific fractions.

In particular, this project aims to investigate the compound specific isotope ratios of compounds such as terpenes, aromatic compounds, sugars, phenols, organic acids and/or lipid compounds (e.g. fatty acids or similar compounds) from food and beverages in order to identify characteristic parameters that can be used to verify the genuineness of specific products based on geographical origin or the addition of exogenous material, in particular of compounds of synthetic derivation.
Reserved Scholarship

E - Characterization of the mechanism of action of a new sustainable fungicide

Funding Body:
Fondazione Edmund Mach
Bi-PA NV (Belgium)

Supervisor/s
1. Claudia Maria Longa (FEM)
2. Michele Perazzolli (UNITN)

Context / Synthetic description of the project and research outcome

2. General description of the Project

One of the important goals of modern agriculture is the transition to a more sustainable and eco-friendly approach as requested by consumers and the market, providing an efficient crop disease control with a limited ecological impact and a maximised economic sustainability for the farmers. In order to reach this goal, the development of new sustainable solutions for crop protection is a fundamental tool. Therefore, the drive towards research and development of alternative solutions for plant protection has undergone a constant acceleration in recent years. These innovative solutions are fundamental tools for agriculture, in accordance with the goals of the “Farm to Fork Strategy” promoted by European Union, to compensate the increasing limitations on the use of hazardous chemical products.

An innovative and sustainable active ingredient for the control of fungal pathogens has been recently identified and named TriMethylethanolAminePelargonate (TMAP; patent BE1026309B1). The main objective of the PhD project is to identify the mechanism of action of this new sustainable fungicide. The deep knowledge of the mechanisms involved in the fungicidal activity and the identification of TMAP target sites are important steps in the subsequent development process of the fungicide. The fungicidal activity will be investigated in vitro, in order to understand the mechanism of action of TMAP against crop pathogens at cellular level, such as grapevine downy mildew and powdery mildew, apple powdery mildew and apple scab. TMAP features will be studied also in planta, in order to characterize the efficacy and the spectrum of activity in controlled conditions and in semi-field conditions. The direct (antifungal activity) and indirect (plant resistance induction) effects against the selected crop pathogens will be studied to evaluate the local and/or systemic activity. The results of the PhD project will be milestones for the further development of the sustainable fungicide, providing relevant scientific publications and a fruitful training of the PhD student. Some research activities will be carried out abroad in the academic and/or industrial sector for a period of approximately 3-6 months, according to the results that will be obtained and required analyses.
Reserved Scholarship

F - Assimilation of radar data for improving snowmelt modelling in alpine regions (“SnowTinel”)

Funding Body:
Eurac Research

Supervisor/s
1. Giacomo Bertoldi (Eurac Research)
2. Riccardo Rigon (University of Trento)
3. Niccolò Tubini (University of Trento)

Context / Synthetic description of the project and research outcome

Background
The "SnowTinel" project, aims to use Sentinel-1 SAR satellite data and catchment hydrological modelling for an improved quantification of snow-melt dynamics in alpine regions. The project is coordinated by Eurac Research and involves the Institute for the Study of Snow and Avalanches in Davos in Switzerland. The SnowTinel project is supported by the research partnership with the Swiss National Science Foundation (SNF) and the autonomous Province of Bolzano. As part of the SnowTinel Project, is foreseen a PhD position, promoted by Eurac and scientifically followed in collaboration with the University of Trento.

Overall SnowTinel Project aims
Snowmelt is an essential component of the water balance in mountainous regions, and current climate change is altering its dynamics at a rapid rate. The recent increase in the availability of radar satellite products offers great potential to improve our ability to understand and monitor snowmelt processes with high spatial and temporal resolution. However, a better understanding of the physical interactions of the radar signal with the snowpack is needed, to fully exploit the information they generate. The SnowTinel project aims to make better use of the snowmelt dynamics information provided by the Synthetic Aperture Radar (SAR) aboard the Sentinel-1 satellites. Findings obtained at the small Davos Laret (Switzerland) experimental site will be compared with remote sensing observations and combined with physically based snow models and methods of varying complexity in a very well monitored small catchment area (Dischmatal, Davos, Switzerland). The best results will be then tested in an applied scenario for a large catchment (Vinschgau, South Tyrol) where an accurate estimation of snowmelt is required. The area is already facing water use conflicts, as the available water is intensively used for both agriculture and hydropower generation. By clarifying fundamental scientific issues, this project will be able to explore the feasibility of a near – real time monitoring system that can be extended operationally over large areas to deliver practical benefits to society.

Phd goals and activities
From a scientific point of view, the objectives of the doctorate are in the context of the last WP of the project. The Ph.D. will gain competences both in the field of hydrologic modeling than in the field of remote sensing, developing advanced integrated approach with a significant applied impact for water resources management.

**Goal:** Demonstrate the benefits of assimilating SAR data for hydrological applications and surface processes modelling, quantifying uncertainties.

- To evaluate the performance of simpler data assimilation approaches of Remote Sensing SAR data that could realistically be applied in large scale catchments with respect to state-of-the-art hydrological models.
- To evaluate the sensitivity of the modelled runoff and discharge (using state-of-the-art hydrological snow models (i.e. Alpine3D, GEOtop, GEOframe System) to the various aspects and discuss the claims that SAR can provide reliable runoff evaluation on a catchment scale, including mountainous areas.
- To investigate the improvements for water availability estimation (hydropower, irrigation) brought by assimilating the SAR and snow modelling in a pre-operational setting.

**Tasks:** apply the parametrizations for snow melt derived by SAR information at the catchment scale, quantify the benefits compared to not using SAR data. Discuss the uncertainties and applicability of the approach to less well monitored catchments. This means that the gridded datasets with information on elevation, land use, soil conditions and watershed areas for all the test sites will also have to be prepared and delivered.

**Methods**
All the code developed during the Ph.D. will be upload in Github (or similar platform) and will be Open Source according to the GPL v3 license.

The candidate will take care of implementing, besides the code, the appropriate procedures for continuous integration of the evolving source code, and they will be also asked to maintain a regular rate of commits to the common open platform. Despite these conditions, and being free and open source, the code will be intellectual property by the coder as explained by the GPL3 licence and the document on the fair use of GEOframe codes published at http://geoframe.blogspot.com/2021/04/fair-usage-of-geoframe.html. GEOtop developments will be published on-line on its github repository.

The Ph.D. student is intended to produce, besides working and tested codes, also at least three papers in major journals (VQR Class A), of which, at least one as first Author. Duration of the doctoral studies could be three or four years.

The candidate needs to have a good attitude and skills for numerical modelling, but also a good motivation for snow and climate research and a willingness go in the field in winter mountain environment.
**PhD in AGRIFOOD AND ENVIRONMENTAL SCIENCES - CALL 2022 – CYCLE 38**

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<th><strong>Reserved Scholarship:</strong></th>
<th><strong>G - Downscaling and upscaling of fields of atmospheric variables from modelling and observations by means of Artificial Intelligence techniques</strong></th>
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<td><strong>Funding Body</strong></td>
<td>Fondazione Bruno Kessler (FBK)</td>
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</table>
| **Supervisors**          | 1: Dino Zardi (University of Trento)  
                            2: Marco Cristoforetti (FBK)                                                                                                  |
| **Synthetic description of the activity and expected research outcome** | Climate changes and their effects through weather modifications have an enormous impact on countless sectors of society. As a consequence weather services are facing an increasing demand for comprehensive, robust, timely, reliable and high-resolution information from either monitoring systems, or weather forecasts, or climate projections that provide support to the adaptation and mitigation policies. High-resolution (in space and time) fields are a key tool towards addressing the complex challenges society is facing. Their development requires an interdisciplinary expertise between meteorology, physics, applied mathematics and computer science.  
The candidate will develop and apply new concepts in the application of Artificial Intelligence (Machine Learning and Deep Learning) for the spatial and temporal downscaling of forecasts, observations and climate projections from coarse-grained sources.  
The activity will be carried out in collaboration with Fondazione Bruno Kessler and within the activities of Earth & Climate Spoke of the National Center for High-Performance Computing (HPC). |
| **Research group link**  | [https://www.centro3a.unitn.it/](https://www.centro3a.unitn.it/)  
                            [https://dsip.fbk.eu/](https://dsip.fbk.eu/) |
| **Contacts:**            | dino.zardi@unitn.it  
                            marco.cristoforetti@fbk.eu |