IBISBA Italia

IBISBA-IT
National Node Meeting

3 May 2023, Naples

Centro Congressi Federico II, Aula Magna

Via Partenope 36, Naples

Final **Programme**

09.30 - 10.00 **Registration**

Welcome and Introduction

10.00 - 10.10 **Marco Moracci**
Meeting Chair, and founding member of IBISBA

10.10 - 10.25 **Michael O'Donohue**
Director of IBISBA

10.25 - 10.40 **Beatrice Cobucci Ponzano**
Coordinator of IBISBA-IT

IBISBA-IT TNA User Presentations

10.40 - 11.00 **Microbiome Based Foods for Health (MicroBHE)**
Mariaelena Di Biase, ISPA

11.00 - 11.20 **Modulation of the intestinal MICRObiota in SEABASS fed with insect meal supplemented with CHItinase (MICROSPICHI)**
Francesco Gai, ISPA

11.20 - 11.50 *COFFEE BREAK*

11.50 - 12.10 **Enzymatic Processes on Solid Substrates: development of methodologies for the characterization of heterogeneous kinetics of new enzymes for industrial biotechnological applications**
Maria Elena Russo, STEMS

12.10 - 12.30 **Bio-based production of Carbon Dots (CDs) from organic acids produced via fermentation of residual biomass feedstocks (BIODOTs)**
Mariacecilia Pasini, SCITEC

12.30 - 12.40 **Closing Remarks**

with honorary guest

Mauro Bertelletti, *MUR*
IBISBA Ministerial Representative of Italy

13.00 - 14.00 **Networking Lunch**

with IBISBA-IT and EU-IBISBA members

Microbiome based foods for health (MicroBHE)

Mariaelena Di Biase

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I*BISBA-IT installation:* Alma Mater Studiorum - Università di Bologna, Dipartimento di Farmacia e Biotecnologie - FABIT

Scientific referent: Prof. Marco Candela

The MicroBHE project aims at the exploitation of the full “microbiome power” to produce at least 2 new and sustainable fermented foods to favor the restoration of the full GM health-promoting diversity and functionality in urban populations. By modelling the full complement of interactions between discovered food microbiomes components and the gastrointestinal ecosystem - and providing the first biobank of non-commercial food microbiome beneficial actors - the MicroBHE health-promoting fermented foods will be conceived and, the most promising, will be produced at the lab scale. Since determinants, mechanisms and biomarkers driving to NCD risk-associated dysbiotic transitions are only partially understood, endpoints for a successful health-promoting modulation of the human GM will be obtained in the project frame. In parallel, an innovative food microbiomes biodiscovery campaign will be launched, exploiting food microbiomes and isolates from traditional foods. To this aim we will exploit a range of non-commercial microbial hubs and isolates from traditional fermented foods already available to the project, or, we will search for new food and food process microbiomes, hubs and isolates from 1 agri-food fermented waste. This biodiscovery campaign will provide new food and food process microbiomes as a source of beneficial actors (e.g., microbial hubs, species and metabolites) for supporting the health of the human GM, particularly in terms of NCD risk-associated dysbiotic variations. These new actors will be exploited as innovative functional components for the design and processing of the MicroBHE innovative health-promoting fermented foods for the EU market.

Enzymatic Processes on Solid Substrates: development of methodologies for the characterization of heterogeneous kinetics of new enzymes for industrial biotechnological applications (PrESS)

Maria Elena Russo

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I*BISBA-IT installation:* Università degli Studi di Napoli Federico II – Dipartimento di Biologia (DIB-UNINA)

Scientific referent: Dr. Andrea Strazzulli

In the framework of industrial biotechnologies, several enzymatic processes involve solid substrates including residues from process industries, agro-industrial and civil wastes where substrates molecules are often combined in complex structures with inert and inhibiting compounds. Lignocellulosic biomass and plastic wastes are a potential feedstock for the production of fermentable sugars and monomers from polyesters/polyurethanes, respectively. The selection of enzymes from extremophiles as well as the engineering of novel enzymes, having tailored structural and functional properties, can provide active and stable biocatalysts to use in harsh industrial operating conditions.
Quantitative tools for the development of the enabling technologies are necessary together with the knowledge of structure and molecular mechanisms of those novel enzymes. The impact on the overall costs of biomass hydrolysis for biorefinery purposes of the enzymes' cost can be reduced by proper strategies of enzymes dosage and recycling. In the case of lignocellulose bioefinery, these strategies are designed according to the information on cellulases/hemicellulases adsorption on the solid substrates. Despite the extended knowledge on molecular mechanisms as well as enzyme-substrate interactions at nanoscale affecting the activity of processive cellulases, the design criteria of bioreactors for industrial enzymatic hydrolysis are still largely based on empiric observations. PrESS proposes new multidisciplinary methodologies to assess the phenomenon of enzyme adsorption on biomass substrates selected as potential feedstock for biorefinery processes. At least three endo- and exo-glucanases will be selected among extremozymes by the research infrastructure and produced/purified to perform tests on their adsorption on real lignocellulosic biomasses. The results will provide further metrics for future novel strategies for EH bioreactors design and novel criteria for industrial carbohydrate active enzymes' selection.

Modulation of the intestinal MICRObiota in SEABASS fed with insect meal supplemented with CHItinase (MICROSPICHI)

Francesco Gai

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I*BISBA-IT installation:* Università degli Studi dell'Insubria - Uninsubria
Dipartimento di Biotecnologie e Scienze della Vita - DBSV

Scientific referent: Prof. Genciana Terova

Insect meals (IM) have recently been authorized by the European Commission for their use in aquaculture feeds. Several scientific studies have evaluated the inclusion of IM in freshwater and marine fish species as alternative protein sources to fish meal (FM) taking into consideration different levels of inclusion. The presence in the IMs of chitin, an aminopolysaccharide polymer which constitutes the exoskeleton of arthropods, affects the availability and digestibility of proteins and therefore the growth performances of the fish. It is interesting to test the use of fungal chitinases (enzymes able of degrading chitin) in feed containing IM for marine fish such as sea bass (Dicentrarchus labrax), which represents one of the most commonly farmed species in Mediterranean aquaculture.
Sea bass (Dicentrarchus labrax) specimens will be fed with feed containing IM in an amount of 10% supplemented with two different concentrations (0.2% and 0.5%) of chitinolytic enzymes (Aspergillus niger chitinase). At the end of the trial, the growth performance and feed conversion efficiency parameters will be evaluated on the fish, as well intestinal microbiota and immune parameters.
Overall, the results of the project will contribute to increasing knowledge about the microbial ecology of fish fed with insect meals with possible practical implications in terms of intestinal health and well-being of farmed fish. The set of results obtained would provide interesting scientific evidence to improve the use of IM in aquaculture and consequently the environmental sustainability of these productions.

Bio-based production of Carbon Dots (CDs) from organic acids produced via fermentation of residual biomass feedstocks (BIODOTs)

Mariacecilia Pasini

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Scientific referent: Dr. Valeria Mapelli

Carbon dots (CDs) are a promising type of nanomaterial with unique properties. They are composed of sp2 structural carbon cores and surface functional groups, such as amino, hydroxyl, and carboxyl groups. Due to their small size, large specific surface area, and abundant surface functional groups, CDs are highly reactive and sensitive to their surrounding environment. They have attracted broad research interest due to their excellent and tunable photoluminescence, high quantum yield, low toxicity, small size, appreciable biocompatibility, and abundant low-cost sources. CDs have important applications in many fields, including biomedicine, catalysis, and optoelectronic devices.

In addition, CDs have been shown to have a positive impact on the growth and development of rice plants. When added to rice plants, CDs enhance seed germination and growth, possibly due to enhanced nutrient adsorption. Furthermore, CDs degrade to form plant hormone analogues and CO2, which can promote plant growth and increase yield through photosynthesis.

CDs may also impact photosynthesis and plant responses to stress due to their ability to absorb and emit light and generate a photocurrent. Additionally, CDs have been found to interact with water under visible light irradiation to form hydroxyl radicals and Reactive Oxygen Species (ROS), which are positive regulators of Ca2+ oscillations that modulate plant resistance to drought.

CDs can be produced sustainably from agricultural waste by using microbial fermentation to produce citric acid, which can be used as a precursor for the synthesis of CDs. Different compositions of the fermentation medium can be tested to promote specific functionalization of CDs without further chemical reaction downstream of the fermentation process. The proposed project aims to establish a circular and bio-based economy process where plants are able to produce feed and reuse their own waste, which has significant sustainability implications.

Organising **Committee**

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