ANNEX 1/c

PhD program: SCIENCE

XXXVIII CYCLE – a.y. 2022-2023

Department	**Department of Sciences - Potenza**	
Coordinator	Prof.ssa Patrizia FALABELLA e-mail: patrizia.falabella@unibas.it	
Duration	3 years	
Web site	http://scienze.unibas.it/site/home/didattica/offerta-post-laurea.html	
Admission requirements	a) University degree obtained under the previous educational systems (ex ante D.M. 509/99, whose legal course has at least a four-year term); b) Laurea specialistica/magistrale (D.M. 509/99 and D.M. 270/2004); c) Academic title obtained abroad and eligible for access to the PhD program, previously recognized by academic authorities, even in the context of inter-university cooperation and mobility agreements. In the absence of such approval, the candidate must apply a request in the application form according to the Art. 3 of this call.	
Available positions	**Agritech**	**1 scholarship**
	Tech4You	**3 scholarships**
	Other	**1 scholarship Regione Basilicata - FSC** **1 scholarship ENEA** **2 scholarship INPS**

SCHOLARSHIPS

"National Research Centre for Agricultural Technologies" - tematica "Tecnologie dell'Agricoltura (Agritech)"

Codice identificativo CN00000022 - CUP C33C2200025000

Scholarship n. 1	**Spoke n. 2 – Crop Health: a multidisciplinary system approach to reduce the use of agrochemicals** **WP 2 - TASK 2.2.4**

Research topic

Fungal phytotoxins and their synthetic analogues as environmentally friendly biopesticides

Topic description

The obtainment of new environmentally-friendly, selective, and not-toxic agrochemicals is a major goal for the development sustainable agriculture. In this framework, bio-pesticides based on metabolites extracted from plants and microorganisms constitute one of the most promising approaches. In fact, natural compounds usually present high specificity toward the target pathogens, lower toxicity than synthetic pesticides, and faster degradation in the environment, thus decreasing the risk of water and soil pollution, as well as lowering the toxicity risk towards animals and humans. Among the most promising bio-

pesticides, fungal phytotoxins have an increasing role. In fact, these metabolites have often very high target specificity and low toxicity profile towards not-target plants and animals, so that their possible applications as selective herbicides, fungicides, bactericides, nematocides, and insecticides have been widely demonstrated. The main problem with fungal bio-pesticides is their low availability from natural source, because fungal cultures produce very low amount of compound and the metabolites production is highly variable depending on growing conditions and fungal strain genetic variation. It follows, that to carry out extensive studies and field application of bio-pesticides of fungal origin the development of their chemical synthesis is mandatory. The aim of the PhD project will be then the development of novel synthetic strategies for promising bio-pesticides and of their analogues, to carry out structure-activity-relationship (SAR) studies and, eventually, large scale studies in green houses or field. Moreover, given that fungal phytotoxins are chiral compounds, the development of enantioselective total syntheses for their obtainment in optical active form and of novel practical and reliable approaches for their stereochemical characterization will be carried out.

Ecosistema dell'Innovazione "Tech4You - Technologies for climate change adaptation and quality of life improvement" - ambito di intervento "5.Climate, Energy and Sustainable Mobility"

Codice identificativo ECS00000009 – CUP C43C22000400006

Scholarship n. 1	**Spoke 2 – Tecnologie per ridurre il consumo energetico e salvare la biodiversità** **GOAL 2.1 - PP 2.1.1**

Research topic

Novel Materials for Energy Production from Solar Source

Topic description

The unrelenting exhaustion of the fossil energy sources pushes to research for renewable and alternative energies, such as photovoltaics. In this scenario, the new organic photovoltaics (OPV) technology took the interest of an increasing number of researchers. The OPV panels are very appealing due of their versatility and cheapness, being obtainable by ink-jet printing on large and flexible surfaces, and then being much more suitable than traditional silicon-based panels for architectural purposes. However, the efficiency of OPV photovoltaic technology is still lower than silicon panels, thus the need of new molecular materials for OPV is still a major task of the research in this field. Among the materials employed in OPV, tetrapyrroles have a major role. In fact, they exhibit intense spectral response bands in the UV-vis region and possess good chemical, photo-, and thermal stability, providing good potential candidates for photovoltaic applications. In the last years, the group which proposes this Ph.D. Project focused its research activity on the the development of new photovoltaics materials based on porphyrazines, a particular class of tetrapyrrroles. This allowed to obtain efficient photovoltaic devices based on nanocomposites of porphyrazines with both carbon nanotubes and graphene, as well as dye sensitized solar cells (DSSC) with hydroxy or carboxy substituted porphyrazines. The topic of this Ph.D. project will be the development of new porphyrazines as promising donor materials for the preparation of OPV solar cells. This will be obtained by (a) synthesizing new molecules bearing polar groups suitable for TiO_2 anchoring or extended aromatics capable ·-· interactions with nanocarbons; (b) investigating the spectral and electrochemical properties of the new compounds; (c) preparation of nanohybrids of these materials with carbon nanotubes and graphene; (d) construction of OPV solar cells and evaluation of their photovoltaic efficiency.

Scholarship n. 2	**Spoke 4 – Resilienza e accessibilità per la valorizzazione del patrimonio locale (culturale e naturale**) **GOAL 4.1 - PP 4.1.3**

Research topic

Innovative tools and methodologies for diagnostic and conservation of archeological cultural heritage

Topic description

The proposed Ph.D. project is consistent with objective 11.4 of the 2030 Agenda and with the National Recovery and Resilience Plan (P.N.R.R). The project proposes research that considers the archaeological artifacts of the Basilicata Region to contribute, in an innovative and environmentally friendly way, to the conservation and protection of our archaeological heritage: memory and cultural wealth to enhance the territory and its economic, touristic and social potential. After visual analysis and macroscopic evaluation of the state of deterioration (chemical and biological) on the assets, non-destructive diagnostic analyzes will be carried out for the chemicalphysical characterization of the constituent materials in order to

determine their vulnerability and identify suitable methods of rehabilitation and conservation. After the identification of the biodeteriogens present on the surfaces of the works to be safeguarded, using biomarkers and suitable sequencing techniques, the surfaces will be cleaned using extracts of wild plants, fungi and bacteria with marked biocidal activity which, unlike synthetic products, are effective at low concentrations, do not interfere with the constituent material of the asset and safeguard the health of operators in the sector and the environment. All the activities will be carried out thanks to the synergistic and multidisciplinary action of skills put in place by UNIBAS (Contact person: Prof. L. Scrano), by the Management Group SRLS (Contact person: S. Del Brocco), a restoration company registered in the Register of the Ministry Beni Culturali specialized in the sector of conservation treatments of cultural heritage and by the Foreign Partner "Centre Interdisciplinaire de Conservation et Restauration du Patrimoine (CICRP)", located in Marseille (Contact person: Dr. P. Bromblet) which deals with curative and preventive conservation and the study of the phenomena of degradation of materials and their restoration.

Scholarship n. 3	**Spoke 3 - Tecnologie intelligenti per una filiera alimentare e forestale sostenibile GOAL 3.3 - PP 3.4.1**

Research topic

Breeding of bioconverter insects for the valorisation of by-products into valuable substances

Topic description

The PhD project involves the setting up of a pilot farm of the bioconverter insect Hermetia illucens, fed with residual biomasses (by-products) derived from the agri-food chain, aimed at the production of new raw materials for various applications. At the end of the bioconversion process, various products of high biological, ecological and economic value are expected to be obtained, including the larvae which will be destined for the production of wholemeal flour to be used as feed, larval frass, which will be chemical and microbiological characterized and subsequently used as fertilizer in agriculture, and chitosan, deriving from chitin extracted from pupal exuviae and dead adults. Chitosan, following a chemical-physical characterization, will be used as biostimulant on selected plant species, in order to evaluate the potential antibacterial, antifungal and elicitory effect (stimulation of the natural defense mechanisms of plants), as well as potential bioinsecticide.
The achievement of the project objectives will represent an important milestone in the search for alternative and sustainable protein sources for animal feed (pet food, aquaculture, poultry and pigs) and in the future for human nutrition, and in the search for new materials of natural origin to be used in the agricultural sector, in order to replace or reduce harmful chemical substances, with a view to environmental protection.

OTHER SCHOLARSHIPS

Scholarship n. 1	**Regione Basilicata - FSC**

Research topic n. 1

New technologies for the purification of wastewater and polluted water

Topic description

Emerging contaminants (ECs) are defined as newly identified or previously unrecognized pollutants. They include products used daily, such as surfactants and surfactant residues, pesticides, pharmaceuticals, and personal care products. Many of these substances escape to conventional activated sludge wastewater treatments allowing them to reach surface water streams and distribute in the environment. For most ECs, occurrence, risk assessment, and ecotoxicological data are unavailable; therefore, it is difficult to predict their health effects on humans and living organisms. Many processes have been described for the removal of organic compounds in polluted water, including advanced oxidation processes (AOPs) and filtration on natural materials. The application of AOPs has become of real importance since it has the potential to oxidize a wide range of organic compounds that are difficult to degrade biologically in wastewater, leading to their complete mineralization or to the formation of more biodegradable intermediates. At the same time, the removal of pollutants by adsorption via filtration columns remains a widely used technology since it is advantageous in terms of energy, area demand, and cost. However, there is still a large gap in information on the growing number of new potential contaminants that are appearing, especially in their unpredictable transformation products. The complexity of the matrices and the low

concentrations at which these contaminants are present in the samples require highly selective and sensible analytical methods for their identification.
This project aims to evaluate the effectiveness of different AOPs and different natural sorbent for the purification of wastewater and polluted water and to perform the analytical determination of emerging pollutants and their degradation products in the investigated matrices using Liquid Chromatography or Gas Chromatography coupled with Mass Spectrometry (LC-MS or GC-MS).

Research topic n. 2

Development of precision anticancer therapies through the use of molecules capable of inhibiting or reprogramming the activity of new and specific molecular targets

Topic description

It is widely accepted that cancer cells alter their metabolic pathways to generate more fatty acids for lipogenesis, to meet the increasing energy demand for rapid cell division and propagation. This reprogramming of the metabolic pathways of cancer cells is due to the alteration of the expression of some genes, which directly control glycolysis, lipogenesis and nucleotide synthesis, and have the potential to be considered prognostic markers and therapeutic targets in the development of new anticancer drugs. A classic example of a reprogrammed metabolic pathway in cancer is the Warburg effect or aerobic glycolysis, which is characterized by an increased rate of glycolysis, resulting in high lactic acid production despite having sufficient oxygen.Reprogramming of glucose metabolism and related metabolic pathways may contribute to the design of new therapeutic strategies to improve the efficacy of cancer therapy.A regulatory molecule of multiple physiological and pathophysiological processes such as insulin secretion, inflammation, neurological disorders and cancer is citrate. The anticancer properties of citrate have been reported on several cancer cell lines however, the effects of citrate to support cell proliferation have also been described. Citrate is an essential intermediate in the tricarboxylic acid (TCA) cycle There is growing evidence suggesting that exogenous citrate may provide the anticancer effect by regulating some key enzymes of glycolysis, TCA cycle, gluconeogenesis and acid synthesis fat. Furthermore, since citrate is the molecule that supplies the acetyls necessary for both lipogenesis and histone acetylation, it exercises epigenetic control of the expression of numerous genes. In this context it is proposed to epigenetically modify the tumor cells with citrate and from the analysis of the transcriptome to choose the most suitable treatment

Scholarship n. 2	**ENEA - Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile**

Research topic

Recovery substances with antipathogenic effects from organic agro-industrial waste using suitable microorganisms.

Topic description

Agro-industrial by-products of major importance in the territory will be used as substrate for the growth of suitable microorganisms, microbial consortia or unicellular vegetable organisms. This task will study the optimal operating conditions for growth, as well as the best formulation of agro-industrial substrates and any required pre-treatments. Microorganisms, such as Bacillus subtilis, can grow advantageously on residues from the dairy or brewing sector, and synthesize substances with a strong antipathogenic action, such as iturin. The biomass deriving from the bioreaction process is concentrated and then dehydrated in such a way as to maximize the conservation period and the microorganism's vitality. In a circular perspective, the culture broth is treated to recover the iturin and other interest compounds. The process optimized on a bench scale is developed and optimized on a pilot scale. In vitro and in vivo tests using the microorganisms' biomass will be conducted to verify its antipathogenic activity.
The objectives of this activity are the development and scaling up of the production processes of substances with antipathogenic activity starting from agro-industrial waste, after their sustainable conversion based on the use of microorganisms. This task will lead to at least 2 antipathogenic substances to replace agrochemicals, valorizing at least 3 agro-industrial by-products. The task will aim at a sustainable increase in plant growth of at least +40%.

Scholarship n. 3	**INPS**

Research topic

Bi-hyaluronic: Hyaluronic acid-inspired biomaterials

Topic description

The general objective of the proposed research activity is the production of electrospun hydrogels and matrices consisting of hyaluronic acid conjugated to bioactive peptides, for the production of innovative patches bio-eco-compatible by technologies falling within the framework of the additive manufacturing to develop in the pharmaceutical industry, such as the elettrospinning and 3D printing.

Scholarship n. 4	**INPS**

Research topic

Identification and characterization of new insect-derived antimicrobial peptides: an innovative approach against antibiotic resistance

Topic description

The proposed research project aims at the identification and characterization of Antimicrobial Peptides (AMPs) from innovative sources, insects in particular, in response to antimicrobial resistance (AMR), a global health and social priority. AMPs, molecules involved in innate immunity, do not act on eukaryotic cells but selectively on a broad spectrum of microorganisms, including those resistant to antibiotics, due to their chemical-physical characteristics, including the net positive charge, which allows them to interact with the bacterial wall and membrane, negatively charged, causing their lysis but they do not interact with positively charged eukaryotic cells. This mechanism of action, different from that of traditional drugs, makes the development of AMR a mechanisms very rare. Furthermore, AMPs show synergistic activity with conventional antibiotics. Although all organisms produce AMPs, insects represent the richest and most unexplored source of them due to their high biodiversity and to the adaptive strategies developed throughout their evolutionary history. The project in line with the scientific-disciplinary fields of the PhD Programme and with the composition of the Academic Board is consistent with the National Smart Specialization Strategy. It is coherent with "Health, nutrition, quality of life" area and with the "Biotechnology, bioinformatics and pharmaceutical development" trajectory, recognizing biotechnology's contribution to improving the quality of life by offering better treatment options.

A period in the company or research center (max 6 months) and abroad (max 6 months) is mandatory.

Admission procedure	The admission procedure is conducted through the: **a) evaluation of qualifications** **b) evaluation, as part of the interview, of a research project**, drawn up in Italian and English using the format set out in **Annex C** to the call for proposals, concerning the subject/type of grant for which you are competing (Agritech, Tech4You, other) **c) video conference interview** using google meet

Evaluation criteria	a) **evaluation of qualifications:** up to a maximum of **25 points** minimum score to access the interview **15 points** b) **interview:** up to a maximum of **75 points** the interview is passed for a score not less than **45 points** **Minimum total score: 60 out of 100**	
Assessable qualifications	**Graduation Thesis** (The candidate must also submit a summary in Italian or English of the thesis of max 16.000 characters)	max **5** points
	Degree mark (For candidates who have not yet obtained the degree, the weighted average of the marks obtained in all the exams of the degree program, taken on the date of submission of the application for admission, will be evaluated)	max **16** points
	Scientific publications (Articles in national and international scientific journals, proceedings of scientific conferences, books or book chapters)	max **2** points
	Other titles (University degrees or Master Specialization, Research Grants, Scholarships, Erasmus scholarships and periods of activity abroad, …)	max **2** points
Interview program	The interview, which can be held in Italian or English, will focus on the discussion of the submitted research project and is aimed at ascertaining the candidate's scientific interests and aptitude for research. During the interview, the knowledge of the Italian language will be ascertained for foreign candidates.	
Foreign language	**English** (knowledge of a foreign language will be assessed during the interview)	
Schedule of the admission tests	**Evaluation of qualifications: results will be available from <u>January 26, 2023</u>** on the website http://portale.unibas.it/site/home/didattica/dottorati-di-ricerca.html **Day of the interview: <u>January 30, 2023 - 10:30 a.m.</u>**	