APPENDIX CALL FOR APPLICATIONS FOR ADDITIONAL PHD SCHOLARSHIPS ON GREEN TOPICS
(ACTION IV.5)

Research Topics

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Microbiological approach to improve the sustainability of wine production and reduce the impact of climate change on wine quality
Supervisor	Viviana Corich
PhD Programme	ANIMAL AND FOOD SCIENCE
Curriculum (if foreseen)	
Project description	The yeast Starmerella bacillaris is naturally present on grapes. Despite its poor fermentation performance, it produces high glycerol level (improving the wine "body"), partially reduces alcohol content and increases varietal aromas. It also has a marked antifungal activity against Botrytis cinerea and Pencillium expansum, two of the most widespread phytopathogens. With the aim of reducing the environmental impact caused by synthetic fungicides, S. bacillaris will be investigated as biocontrol agent in the vineyard and grape bioprotectant, immediately after harvest. Due to its ability to reduce protein instability and alcohol content, the use of S. bacillaris as co-stater will also be evaluated. The climatic changes that affect vineyards have changed the composition of grapes, making the action of yeast in the cellar less effective. New formulations of additives, based on yeast extract, will be studied to ensure the maintenance high wine quality.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Nanotechnology for Plant Biostimulants: Nanoparticles and Nanoencapsulation
Supervisor	Antonio Masi
PhD Programme	ANIMAL AND FOOD SCIENCE
Curriculum (if foreseen)	
Project description	To face the adverse effects of rapidly changing climate on agroecosystems, multidisciplinary research to develop new green and sustainable approaches to primary production is required. An emerging topic in this field is the use of biostimulants, ecofriendly substances used to enhance plant growth; they are inert for the ecosystems, often obtained from waste materials, and their utilization is widely reported in the literature as enhancing tolerance against stress or increasing crop production at very low doses. Another hot topic for sustainable development is the use of nanomaterials. Research on agricultural nanotechnology applications is increasing, but its real contribution to the agricultural sector is still uncertain. Together with a partner company, we will combine nanotechnology and plant biostimulants to create substances with enhanced delivery and controlled release, or compounds able to control crop diseases, or nanoparticles inducing biostimulant responses in plants.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Study of earthworm population and landscape composition for sustainable agriculture
Supervisor	Giuseppe Concheri
PhD Programme	ANIMAL AND FOOD SCIENCE
Curriculum (if foreseen)	
Project description	The tillage, the lack of green infrastructures, the use of chemicals to control weeds, fungi and other parasites, can be the main causes of biodiversity loss, thus causing a weakening of the agroecosystem balance. In this context, earthworms play a central role through the decomposition of the soil litter with the production of humified material rich in macronutrients, improving the growth of tree species and agricultural production, contributing to pedogenesis, the development of the profile, the structure of the soil with the reduction of water stagnation and the active dissemination of bacteria and fungi. The evaluation of the soil health by the analysis of this taxonomic group with the evaluation of landscape components, the identification of agronomic management, the assessment of the chemical-physical conditions and soil fertility, are crucial to characterize the agroecosystems and promote improvement interventions together with the farmers.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Innovative feeding and rearing strategies for improving sustainability of aquaculture
Supervisor	Angela Trocino
PhD Programme	ANIMAL AND FOOD SCIENCE
Curriculum (if foreseen)	
Project description	Aquaculture is a well-recognized food sector for its high efficiency in producing nutritious protein-rich foods. However, it is often condemned for unsustainable production practices, especially regarding the use of aquafeeds, containing fish oil and fishmeal obtained from small pelagic species, and its impacts on the environment as for water and land use, besides associated pollution. Research within the present PhD project will investigate the use of alternative vegetal and animal raw materials, with special emphasis on insect meals and by-products, in aquafeed for different farmed species. These aquafeeds will also be evaluated in both recirculating aquaculture (RAS) and aquaponics (AQ) systems, which permit sustainable use and reuse of water and fish byproducts, besides animal and vegetable food production under a variety of environmental conditions. A multidisciplinary approach will be used evaluating performance and quality of farmed fish and vegetables, besides fish health and welfare.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Development of extracts and fermented officinal plants for food use endowed with sensory, antimicrobial and nutraceutical properties
Supervisor	Alessio Giacomini
PhD Programme	ANIMAL AND FOOD SCIENCE
Curriculum (if foreseen)	
Project description	Plants are well-known as rich source of bioactive compounds and indigenous microflora which exert health-promoting effects. Fermented foods have unique functional properties due to the presence of functional microorganisms, which enhance nutraceuticals, eliminate undesirable components, prevent food deterioration, and fortify food with bioactive compounds. Modern consumers are increasingly interested in their health and expect the food that they eat to be healthy or even capable of preventing illness. Therefore, an increase in the consumption of fermented foods as functional foods, nutraceutical-based foods, and bio-foods is being observed. The PhD project will consider various plants and/or plant extract provided by AGRIPHARMA that will be used for fermentation trials, by using bacteria and/or fungi able to develop on these substrates. After fermentation, the resulting materials will be evaluated for the presence of new properties and/or potentially beneficial molecules
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	E - Aerospace and defence
National Research Program PNR 2021-2027	4. Digital, industry, aerospace
Project title	Toward a sustainable space: new telescope for continuous space debris tracking
Supervisor	Roberto Ragazzoni
PhD Programme	ASTRONOMY
Curriculum (if foreseen)	
Project description	A sustainable, green space is a mandatory requirement to avoid jeopardizing mankind access to the outer space. Crucial in basically all of the initiatives that revolve around the making of an eco-friendly space is the tracking of space debris. The smaller pieces revolving around the Earth, being inherently faint and subject more than the larger to non gravitational forces, requires continues and accurate tracking by large aperture telescopes. The project is to inject a doctorate into the development of a whole-sky large aperture telescope (Mezzoocielo, Ragazzoni et al. SPIE proc. 11445, 1144534) that overcome by at least two orders of magnitude what is considered by Space Agencies the current state of the art of wide field telescope to serve such a purpose (the FlyEye, by the way introduced by the same proposing group). As debris observations are only possible close to twilights obvious dual use for Near Earth Objects patrolling and transitory astronomical events are evident.
Mandatory traineeship	12 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	Novel formulation for Botulinum Neurotoxin delivery via hydrogels based on polysaccharides from natural sources
Supervisor	Marco Pirazzini
PhD Programme	BIOMEDICAL SCIENCES
Curriculum (if foreseen)	
Project description	50 nanograms of Botulinum Neurotoxin A (BoNT/A), the most lethal toxin known to humans, kill a person. Yet, BoNT/A is sold in millions of doses/year (>5 billions $/year!) to treat severe neurological disorders and as a popular treatment in aesthetic medicine. Due to its potency, BoNT/A is injected in minute amounts (picograms) and locally to avoid side-effects via off-target diffusion. The effect is thus transient and requires recurrent administrations. Current BoNT/A formulation only includes albumin to prevent vial-sticking and the toxin is practically used as a raw material. Our goal is to upgrade BoNT/A formulation with injectable hydrogels based on natural, renewable, biodegradable and eco-friendly polysaccarides (Gellan Gum, Tamarind polysaccharide, carrageenan, locust bean gum). The hydrogel shall incorporate BoNT/A and, after injection, will serve as high-capacity slow-releasing reservoir of toxin to achieve a long-lasting local-delivery while avoiding off-target diffusion.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	Untangling the role of ER stress and membrane lipid imbalance in fine particulate matter exposure
Supervisor	Diana Pendin
PhD Programme	BIOMEDICAL SCIENCES
Curriculum (if foreseen)	
Project description	Chronic exposure to fine particulate matter (PM2.5) affects endoplasmic reticulum (ER) homeostasis, triggering ER stress and initiating the unfolded protein response (UPR). Recent studies revealed a bidirectional relationship between UPR activation and lipid homeostasis, e.g., membrane lipid composition. Moreover, PM2.5 exposure has been linked to altered lipid metabolism and oxidation. Despite these data, the contribution of ER and plasma membrane lipids in UPR upon PM2.5 exposure remains understudied. We propose to investigate in cultured cells and murine models the impact of PM2.5 exposure on intracellular stress signaling pathways, focusing on membrane lipid homeostasis. Automated, quantitative high-content screening microscopy will be employed to assess cell and ER membrane morphology, associated with lipidomic analysis. Lipid dietary supplements and pharmacological interventions focused on lipid biosynthetic pathways will be tested for they ability to recovery ER homeostasis.
Mandatory traineeship	9 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Development of a yeast-based system to remove and recover heavy metals
Supervisor	Raffaele Lopreiato
PhD Programme	BIOMEDICAL SCIENCES
Curriculum (if foreseen)	
Project description	Heavy metals (HM) are extremely toxic to all living organisms. HM decontamination is mainly carried out by physical-chemical processes, further affecting the environment. Instead, bio-adsorption is an eco-friendly process based on the intrinsic ability of yeast cells to reversibly sequester ions, and can be enhanced by genetic engineering, but it is still a major challenge. Here, we propose to modify the genome of natural S.cerevisiae strains, isolated by the partner Company, to specifically express on their cell surface metal-binding proteins. Multiple functional and biochemical assays will be performed on the recombinant strains, to deeply characterize their ability to either remove and recover metals. Biological efficiency will be further improved by directed in vitro evolution of the strains. Finally, in the Company Lab protocols for use and large scale preparation of the yeast cells will be optimized.
Mandatory traineeship	9 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Development of “green” bioactive surfaces to restore marine life
Supervisor	Laura Airoldi
PhD Programme	BIOSCIENCES
Curriculum (if foreseen)	Evolution Ecology and Conservation
Project description	The project will generate new experimental knowledge of the physicochemical and biological factors facilitating marine life growth in artificial and natural hard bottom habitats. This knowledge will be used to develop innovative bio-inspired and biomimetic materials and surfaces that actively support the growth of target biota (invertebrates, vegetation, fish) for the restoration of marine life. Focus will be on environmentally friendly materials (such as sand, calcium carbonate, shellfish shells, bound together using an inorganic hydraulic binder, as well as innovative biodegradable materials derived from marine vegetation) combined into biomimetic surface topographies (using advanced 3D printing techniques to fabricate custom modular components that reproduce natural structures and surfaces). The performance of these novel technologies will be tested in the field under a variety of environmental (e.g different climate) and biological (e.g different habitat-forming species) conditions.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Lettuce 3.0 - From farm to lab, to fork: the genetic bases of microbe-induced plant resilience
Supervisor	Marco Giovannetti
PhD Programme	BIOSCIENCES
Curriculum (if foreseen)	Genetics, genomics and bioinformatics
Project description	Agricultural sustainability can be achieved through the reduction of fertilizers. When exposed to nutrient limitations, such as phosphate starvation, plants are able to recruit specific microbes. This ability strongly relies on the plant genome which shows great variation among varieties even of the same species. With the final aim of identifying genes, alleles and their impact in molecular processes regulating microbe-induced plant resilience to phosphate starvation, the PhD student will be involved in phenotyping 134 fully sequenced Lactuca sativa varieties. Plants will be grown under phosphate starvation with microbial biostimulants at the private greenhouse of the industrial project partner. We will study metabolic and growth effects and, through genome-wide association studies, their associations with the plant genotypes. Understanding the plant genetic variations mediating the microbe-inducible plant growth effects is a necessary step towards a much-needed new green revolution.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Development of sustainable technologies to produce oils for food applications
Supervisor	Tomas Morosinotto
PhD Programme	BIOSCIENCES
Curriculum (if foreseen)	Biochemistry and biotechnology
Project description	The project aim is to produce oils for the food industry using unicellular algae instead of plants to reduce the negative environmental impact of intensive agriculture. Algae have major advantages in terms of sustainability: they can use CO2 waste from industrial processes (e.g. fermentation or combustion), their cultivation do not compete with plant crops for arable land, they can grow in seawater. One current limitation is that the lipids profile of algae is not optimal for food industry. This will be addressed using genome editing approaches developed at DiBio. By modifying genes of the lipids biosynthesis, the algae fatty acid profile will be modified, making it more valuable for the food industry. In particular, the objective is to make the lipid profile of the seawater alga Nannochloropsis close to the one of palm oil (quantified target: maximal difference in major fatty acids ± 10%), whose large-scale production causes several environmental issues.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Harnessing plant endophytes in making agroecosystems more resilient to climate change
Supervisor	Michela Zottini
PhD Programme	BIOSCIENCES
Curriculum (if foreseen)	Biochemistry and biotechnology
Project description	The ongoing process of global warming is causing dramatic changes in environmental conditions worldwide. In this context it is necessary to define management protocols that promote sustainability by supporting the maintenance and improvement of biodiversity within the agro-ecosystems. Objective. In this project, we aim at exploiting the natural endophytes biodiversity existing in grapevines to investigate possible application to ameliorate grapevine resilience to drought stress. Methodology. Microbial endophyte consortia conferring the highest resistance to drought stress in grapevine cultivars will be selected under controlled conditions and applied to sanitized grapevine plants. Plant response will be characterized at physiological and molecular levels by a multidisciplinary approach to determine the mechanisms underlying the modulation of the grapevine response to drought due to microbiomes. Beneficial microbial associations will be identified by means of metagenomic approaches.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Marine invasive species and fisheries in the Lagoon of Venice and Northern Adriatic Sea
Supervisor	Carlotta Mazzoldi
PhD Programme	BIOSCIENCES
Curriculum (if foreseen)	Evolution ecology and conservation
Project description	Invasive species represent threats to marine biodiversity and human activities, such as fisheries. In the northern Adriatic Sea and Venice Lagoon two invasive species are quickly spreading: the warty comb jelly Mnemiopsis leidyi, a ctenophore which has severely impacted the Black Sea ecosystem and now menaces Venetian fisheries, and the blue crab Callinectes sapidus, a voracious omnivorous predator. The project aims to: 1)clarify the biology of the two species evaluating their occurrence in the VeniceLagoon and Adriatic Sea in relation to season, environmental gradients (incl. lagoonhabitats), and weather, through direct sampling and recovery of fishers' ecologicalknowledge;2)analyse their ecological and socio-economic impacts on ecosystems and fisheries,by analysing landing records in Chioggia and Burano covering both lagoon and sea;3)starting from the obtained results, design and assess management strategies,mitigation actions and emerging opportunities for their exploitation.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Plant cell factories for the production of natural products as sustainable row materials for the industry
Supervisor	Livio Trainotti
PhD Programme	BIOSCIENCES
Curriculum (if foreseen)	Biochemistry and biotechnology
Project description	Plant cells produce a plethora of useful molecules as secondary metabolites, peptides, nucleic acids and sugars used as row materials for the pharmaceutical, cosmetic, food and chemical industries. We propose to develop a plant cell platform able to rapidly satisfy the needs of several types of biomolecules for the pharmaceutical and agrochemical sectors. By combining the screening of the available biodiversity in plant genera known to produce secondary metabolites and the ability to quickly modify their genomes by genetic engineering and genome editing we will produce and do preliminary tests on the biological activities of several plant cell extracts. The chemical characterization of selected ones will be carried out in collaboration with Stefano Mammi at DiSC. The collaboration with a company (ABR) already producing plant cell extracts and one already using plant-derived ingredients (Biolchim) will allow to develop both row and customer-ready product prototypes.
Mandatory traineeship	9 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Power to gas: metagenomics and metabolic modeling for the optimization of anaerobic CO2 capture and green biomethane production
Supervisor	Giorgio Valle
PhD Programme	BIOSCIENCES
Curriculum (if foreseen)	Genetics, genomics and bioinformatics
Project description	Anaerobic digestion (AD) converts complex organic matter into biomethane. The biogas upgrading process is based on a hydrogenotrophic methanogen-dominated microbiome capturing CO2 while producing biomethane (purity > 95%). The project aims to promote Zero Waste (Zero CO2 philosophy) through bio-methanation process based on molecular analyses combined with in silico metabolic modelling. Metagenomics and biochemical data will be joint in the context of LIFE CO2toCH4 project that financed the creation of a mobile anaerobic reactor for energy storage based on CO2 capture. Cooperation with BTS Biogas s.r.l. is intended to replicate the mobile unit, to provide microbial resource management and collect data for model optimisation. Kiel University will enrich the genome-guided metabolic reconstruction approach, essential for accurate prediction of the dynamics influencing the AD microbiome. Overall, predictive capacity of flux balance analysis will be used to improve methanation performances
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Application of intronic markers to sustainable management of natural fish resources
Supervisor	Leonardo Congiu
PhD Programme	BIOSCIENCES
Curriculum (if foreseen)	Evolution ecology and conservation
Project description	The sustainable development of the fisheries industry depends on the long-term conservation of natural stocks. In collaboration with Eurofishmarket (EFM) (https://www.eurofishmarket.it/), landmark company in counseling for the production, processing and distribution of fish products, we aim at developing and applying universal intronic markers to analyse commercially relevant species and promote an informed management of fish resources. These markers, presently under development for fish species at UNIPD, proved to have high potential in detecting diversity at different levels (species, hybrids, populations, stocks, etc.). The goal of UNIPD is to deepen these aspects and extend the use of introns to the main critical issues identified by EFM, related to traceability of commercial products. EFM will also play a crucial role in obtaining samples and disseminating results as well as in training the PhD student on dynamics and priorities of the fisheries sector.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	INTERRUP - INTERpRetable & Unsupervised aPproaches for the reduction of energy consumption, raw material usage and defected products
Supervisor	Gian Antonio Susto
PhD Programme	BRAIN, MIND AND COMPUTER SCIENCE
Curriculum (if foreseen)	Computer Science and Innovation for Societal Challenges
Project description	INTERRUP will develop interpretable Machine Learning (ML)-based Anomaly Detection (AD) methods for industrial scenarios; prompt detection of anomalous behavior and identification of causes could lead to major reduction of energy consumption, raw material usage and defects. Unsupervised AD is typically the entry point for ML-based applications in the industry, given the lack of reliably annotated data in productive environment. Unfortunately, effective AD for complex, multivariate systems are typically based on black-box models, that are hardly interpretable for human operators (and typically also for ML developers): this lack of interpretability is one of the reasons that hinder a wider adoption of AD solutions. The goals of INTERRUP are to: (1) design effective and interpretable AD approaches for industrial data that enable quick and simple Root Cause Analysis of anomalies; (2) prove how the developed approaches lead to reduction of energy consumption, raw material usage and defects.
Mandatory traineeship	12 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	E.P.H.E.S.U.S. E-bikes Pedalling for Healthy, Ecological and Smart Urban Sustainability
Supervisor	Antonio Paoli
PhD Programme	BRAIN, MIND AND COMPUTER SCIENCE
Curriculum (if foreseen)	Neuroscience, Technology and Society
Project description	Smart city planners are investing in tech that promotes the health and well-being of their citizens. Urban mobility is one area they are focused on. E-bikes provide low impact exercise, making them a viable option for those of all ages and fitness levels, even individuals with injuries. The aim of the project is to investigate the long term effects of the use of e-bikes not only on environmental improvement but also on citizens' health in a global and circular health perspective. We will the investigated an integrated approach to a sustainable mobility with a smart system that, giving physiological parameters' feedback directly to the subject and to the electrical e-bike's engine will allow to optimize physical effort, decreasing fatigue sensation, improving exercise adaptation and exercise compliance, moreover we will collect voluntary GPS data on e-bike urban layouts. We will implement the integrated system and compare it to traditional e-bike measuring physiological and urban mobility outcomes.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Investigation of enabling mechanisms for green driving via 5G-and-beyond mobile networks
Supervisor	Claudio Enrico Palazzi
PhD Programme	BRAIN, MIND AND COMPUTER SCIENCE
Curriculum (if foreseen)	Computer Science and Innovation for Societal Challenges
Project description	The urgency of decreasing the negative impact of vehicular transportation on the environment calls for innovative approaches to manage vehicles' routes based on i) traffic conditions, ii) live restrictions from road operators/authorities, and iii) the capabilities of the vehicle (e.g., assuming a hybrid powertrain). Traffic optimization depends on the possibility to gather and treat information simultaneously from vehicles in a region of interest. A crucial role is played by the mobile network, which provides a ubiquitous long-range connectivity to the vehicles. Our goal is to formulate a reasonable model of such an intelligent transportation system. The candidate will investigate the features of the 5G-and-beyond connect-compute chain comprising the mobile core network and edge computing infrastructure that can support such use case. The study shall concern (without being limited by) optimization for resource allocation, network architecture design and green-related services.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Closing the green gap at home: investigating consumers' purchasing attitudes and actual usage of green household appliances
Supervisor	Luciano Gamberini
PhD Programme	BRAIN, MIND AND COMPUTER SCIENCE
Curriculum (if foreseen)	Neuroscience, Technology and Society
Project description	Everyday consumers' usage of household appliances' behavior significantly contributes to the energy wastage, which in turn has a relevant weight on climate change. To foster environmentally sustainable consumer practices, the project addresses the green intention-behavior gap referred to the entire life-cycle of the appliance (LCA). The overall aim of the project is to investigate what are the factors involved in environmentally sustainable behaviors both at the time of purchasing a home appliance, and during the actual usage of the appliance itself. Additionally, by adopting a mixed-method approach, the project will investigate how persuasive techniques can be leveraged to provide customized feedback on energy consumption profile based on the data logged by connectable appliances, thereby raising consumer's awareness and eventually re-educating them toward mindful and ecologically sustainable practices.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	4. Digital, industry, aerospace
Project title	Sustainable Internet of Things, A study on a green approach to develop IoT systems and its impact on human-computer interaction
Supervisor	Antonio Rodà
PhD Programme	BRAIN, MIND AND COMPUTER SCIENCE
Curriculum (if foreseen)	Computer Science and Innovation for Societal Challenges
Project description	Due to the spread of Internet, to the availability of low budget microcontrollers, and to the diffusion of decentralised production infrastructures (Fablabs etc.), IoT has lately seen a big growth that, according to a recent report by Cisco, reaches over 5 billions of devices spread all over the world. Although a single device is usually designed to consume few resources (low power, small dimensions, ...) this growth of IoT devices, when observed as a whole, carries an extremely heavy environmental footprint. The aims of the project are: 1 - To understand through meta-review what are the most unsustainable components of IoT systems (hardware, computational cost, data streaming, etc.). 2 - To propose sustainable alternatives to reduce the environmental impact of IoT systems (e.g. efficient algorithms, re-usable user interfaces, etc.) 3 - To evaluate how the user experience is affected by the proposed sustainable approach, by using as a case study the Internet of Musical Things.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Hydro-N-omics (Improve Ergonomics in Hydroponic Agriculture Industry to Facilitate Environmental Sustainability)
Supervisor	Marco Bergamin
PhD Programme	CLINICAL AND EXPERIMENTAL SCIENCES
Curriculum (if foreseen)	Clinical methodology, metabolism, endocrinology, nephrology and exercise
Project description	Hydroponic farming is different respect conventional agriculture since consumes only 1/5 of the land for the same number of plants being cultivated on a farmland. In general, traditional agriculture can be defined as a 2D feature while hydroponics can be outlined as a 3D model. From this perspective, also the human approach to the work-task (human physical movements of the farmer) and ergonomics are completely different between the traditional agriculture and hydroponics. In this sense, research proposal will investigate in 2-line: the first is the refinement of an ergonomic risk indicator applicable to the agricultural sector with potential applicability to the hydroponic industry, refining current evaluation tools in the lab context. The second line is to apply outputs in the hydroponic context. In this setting, it will be fundamental to match the possibility to optimize the production cycle by reducing the waste of raw materials through the optimization of the manual handling.
Mandatory traineeship	12 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	Role of an eco-sustainable supply chain in the world of food supplements: green tea extract in overweight and obese post-menopausal women
Supervisor	Valerie Tikhonoff
PhD Programme	CLINICAL AND EXPERIMENTAL SCIENCES
Curriculum (if foreseen)	Clinical methodology, metabolism, endocrinology, nephrology and exercise
Project description	The PhD scholarship is designed to promote food supplements security in the face of climate change and biodiversity loss, to improve people's health and quality of life, and care for nature. The principal goal of the project is to develop an eco-sustainable dietary supplement, in particular green tea extract-based food supplement, in order to promote a single-blind randomised trial in overweight and obese post-menopausal women. The loss of estrogen is associated with a change in body fat distribution and increased in central obesity and dyslipidemia, which may explain the acceleration of cardiovascular disease in women after menopause. Green tea extract-based food supplement, the eighth most popular herbal supplement in the US, possesses a great number of bioactive components including polyphenols, especially catechins, which have shown high biological activity (to reduce the absorption of triglycerides, to inhibit LDL oxidation, to decrease HDL-C and to improve insulin resistance).
Mandatory traineeship	8 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	Promoting the mountain area through sustainable, personalized and context-aware hiking
Supervisor	Andrea Ermolao
PhD Programme	CLINICAL AND EXPERIMENTAL SCIENCES
Curriculum (if foreseen)	Clinical methodology, metabolism, endocrinology, nephrology and exercise
Project description	In recent years there has been a surge in mountain tourism associated with increased mountain rescue for inexperienced people and in anthropogenic impact. Trails are classified according to technical difficulties but individual characteristics of hikers are not considered. No applications providing customized recommendations based on age, BMI, physical activity level, pathologies, or risk factors, are currently available. This project aims to develop an algorithm and software to provide for each hiker specific indications regarding ideal walking time, energy consumption and related clinical risk for a specific trial, as well as alternative paths to reduce the anthropogenic impact of tourism. A practical tool will be created and validated to help hikers choose the safest and most suitable route for their functional level and state of health. The project aspires to raise awareness for sustainable outdoor physical activity and valorization of green environment for public health issues.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Circularity and reduction of the environmental impact of cultivated mushrooms
Supervisor	Carlo Nicoletto
PhD Programme	CROP SCIENCE
Curriculum (if foreseen)	
Project description	The project is focused on the optimization of the production process of cultivated mushrooms with reference to the genus Pleurotus and increasing the circularity of the resources used in their cultivation in order to minimize their environmental impact. The research lines are: 1)resilient increase in production through the use of innovative substrates that use organic biomass derived from agro-industry; 2)use of secondary saprophytic fungi able to process the exhausted substrate of the fungus of primary interest for the extraction of compounds for medical use; 3)application of innovative lighting technologies with reduced energy inputs to increase production, quality and biosynthesis of functional compounds in cultivated mushrooms; 4) circular management of the exhausted substrate as a fertilizing component of horticultural crops by increasing the stock of organic carbon in the soil. The activities will be carried out at the University of Padua and the CITICH research Center (Spain).
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Sustainable pest control on ornamentals and innovative crops under greenhouse
Supervisor	Alberto Pozzebon
PhD Programme	CROP SCIENCE
Curriculum (if foreseen)	
Project description	Protected crops are highly efficient systems that maximize plant growth and productivity. These systems, particularly the production of ornamental and young plants, are strongly dependent on intense pesticide use required to fulfill the high commercial standards. Greenhouse crops are usually associated with adverse environmental effects and risks to greenhouse workers' safety. New products such as edible flowers and organically certified young plants are being developed in this sector, but the high dependency on pesticides is still unsolved. Alternative approaches to chemical control based on effective Integrated Pest Management have been successfully used for vegetable crops under greenhouse, but limited research effort has been focused on ornamental and young plants. This research proposal will fill this gap by studying innovative sustainable pest management strategies based on the application of Precision Agriculture methods and biocontrol in the management of greenhouse pests.
Mandatory traineeship	12 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Programs of genetic improvement aimed at the development of new varieties of horticultural and ornamental crops using conventional methods of selection assisted by molecular markers
Supervisor	Gianni Barcaccia
PhD Programme	CROP SCIENCE
Curriculum (if foreseen)	
Project description	The research project is based on a comparative analysis of genetic, morpho-agronomic and biochemical components of biodiversity, with reference to a core collection of horticultural and ornamental species of interest for urbanized territories of the Veneto Region and Italy, in order to select new varieties with low environmental impact. These varieties will find use to renew and enrich green spots in urban areas, thus improving the global degree of biodiversity in the cities, which is directly linked with the quality of life, through the improvement of psychosocial benefits for inhabitants and containment of deleterious effects of pollutants. The main goal is the selection of genotypes amenable to sustainable cultivation systems, which may contribute at mitigating the environmental impact of crops, by reducing greenhouse gas emissions and limiting the consumption of water and fertilizers, while reducing production costs and so increasing the competitiveness of plant nursery companies.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Improving the natural value of the degraded plain environments using the biodiversity of semi-natural grasslands
Supervisor	Michele Scotton
PhD Programme	CROP SCIENCE
Curriculum (if foreseen)	
Project description	In the varied Italian landscape, mountain areas with high agricultural biodiversity, mainly semi-natural grasslands, and plain biodiversity-poor areas coexist. The project aims at experimenting the use of the biodiversity of the seminatural grasslands to improve the natural value in the plain areas and creating a business branch specializing in the re-vegetation with high biodiversity content. In the project a cadastre of Venetian biodiverse grasslands available for seed selling will be created. The fields of land management (e.g., roads, rivers, extensive agriculture) will be identified and sensitized where the creation of high-nature value herbaceous covers is possible and useful. Seed harvesting from semi-natural grasslands and innovative sowing methods and materials for the creation of herbaceous covers in the mentioned land sectors will be experimented. The gained knowledge will be combined in a business branch able to replicate it at professional and national scale.
Mandatory traineeship	12 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Systems biology approaches to develop Saccharomyces cerevisiae industrial strains for the production of second generation biofuels
Supervisor	Lorenzo Favaro
PhD Programme	CROP SCIENCE
Curriculum (if foreseen)	
Project description	The large amount of lignocellulosic residues can be a promising source of biomass for the production of ethanol as biofuel. The limit of this approach is the inability of Saccharomyces cerevisiae natural strains to use cellulose as carbon source for the bioethanol production. In recent years, the introduction of steam explosion to rapidly pre-treat the biomass and of cellulases encoding genes in S. cerevisiae strains represented a significant leap on. However, the presence of several inhibitors, mainly deriving from the lignin degradation, still hampers the possibility to ferment lignocellulosic biomasses effectively, because these inhibiting compounds cause high level of cell mortality and low yields. This project targets the development of superior yeast strains able to both tolerate the presence of inhibitors and hydrolyze cellulosic materials by a novel biotechnological approach combining metabolic engineering, bioinformatic and genomic insights.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	Three-dimensional library of congenital heart disease
Supervisor	Giovanni Di Salvo
PhD Programme	DEVELOPMENTAL MEDICINE AND HEALTH PLANNING SCIENCES
Curriculum (if foreseen)	Oncohematology and human genetics, rare diseases and predictive medicine
Project description	Recently, advancements in artificial intelligence (Al) have begun to transiate into medicine. In particular, the Al-powered analysis of images has reached human-level performance, owing to the efficiency of modem machine learning methods, such as deep learning using convolutional neural networks. Since complex congenital heart disease (CHD) are usually associated with highly variable anatomy, the advent of more intelligent devices able to reproduce precise chamber segmentation and accurate 3D reconstruction is an unmet need. Finally, the possibility to easily share that information may reduce patient's mobility and increase sustainability. AIMS: - Design and application of a novel Al-powered device able to recognize, analyze and reproduce 3D echo images. - Creation of a 3D library of CHD, classified on the basis of diagnostic subgroups, disease complexity, and functional classes. - Creation of a prospective registry far clinical monitoring - Sharing data without patients mobility
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	“Going green”: the sustainability in the Operating Room
Supervisor	Roberto Tozzi
PhD Programme	DEVELOPMENTAL MEDICINE AND HEALTH PLANNING SCIENCES
Curriculum (if foreseen)	Oncohematology and human genetics, rare diseases and predictive medicine
Project description	Practice Green health, a united states hospital sustainability organization, estimates that operating rooms (ORs) are significant contributors to a health care system’s environmental footprint (>30% of a hospital’s waste) (1). Applying an evidence-based approach to sustainability efforts in the OR and beyond, and conducting cost-benefit analyses, are both practical and cost-saving measures to mitigate climate change and positively affect a health system’s bottom line (2). The aim of this project is to develop strategies for minimizing environmental impact of surgical practices, especially on gynaecologic field, creating an Operating Room Green Team (gynaecologic surgeon, a nurse, an anaesthesiologist and an hospital procurement manager). The specific aims will be articulated as follow: (1) Waste Reduction: Recycling OR Materials and Supplies / Reusable OR Items; (2) Waste Segregation; (3) Inhalation Anesthetics.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	High Voltage Gas Insulated Components for Magnetic Confinement Fusion research: efficient and sustainable systems through innovative designs
Supervisor	Paolo Bettini
PhD Programme	FUSION SCIENCE AND ENGINEERING
Curriculum (if foreseen)	
Project description	According to the European Commission, fusion has the potential to provide a safe, economically competitive, and environmentally sustainable solution to the energy needs of the European Union and the whole world. In southern France, one of the most ambitious energy projects in the world today is being built: ITER, a magnetic fusion device designed to prove the feasibility of fusion as a large-scale and carbon-free source of energy based on the same principle that powers our Sun. ITER's most powerful external heating system—Neutral Beam Injection—will be tested in advance of operation at the Neutral Beam Test Facility (NBTF) in Padua. This project falls within the research activities at NBTF and aims at the development of high voltage gas insulated components, through innovative design techniques and exploration of alternative insulating gases to sulfur hexafluoride (SF6), which can hopefully find a broader application in the electric energy chain (production, transmission, consumption)
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Additive Manufacturing of pure copper and copper alloys for High Energy Applications
Supervisor	Piergiorgio Sonato
PhD Programme	FUSION SCIENCE AND ENGINEERING
Curriculum (if foreseen)	
Project description	Additive Manufacturing of pure copper and copper alloys for high energy applications (DTT project): the aim of the project is to apply the metal additive manufacturing technology for the nuclear fusion components production. The metal additive manufacturing is optimal for the construction of very complex geometries, such as the acceleration grids of a nuclear reactor, that requires the presence of internal cooling channels with peculiar shapes. Here are summarized the key points of the whole project: Selection or development of an innovative copper alloy Characterization of the powder (flowability, compactability, etc.) Printing parameters optimization and evaluation of the most appropriate laser for the printing Characterization of the printed samples (density, roughness, chemical composition, microstructure analyses, structural analyses) Thermal and electrical conductivity assessment Thermal treatments on the printed components
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	E - Aerospace and defence
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Assessment of the role of nuclear fusion in future carbon-free energy systems
Supervisor	Chiara Bustreo
PhD Programme	FUSION SCIENCE AND ENGINEERING
Curriculum (if foreseen)	
Project description	In the pathway towards the progressive decarbonization of the European economy, new nuclear technologies are likely to cover a crucial role. Acting jointly with renewables and storage systems, they can provide large amount of carbon-free electricity to cope with the increasing electrification of the almost all energy sectors and baseload firm capacity to enhance the security of electricity supply. Nuclear fusion power offers the opportunity of generating electricity through inherently-safe nuclear reactions and with limited low-activated material production. The doctoral research is aimed at studying nuclear fusion as part of a future energy system for the identification of benefits and hurdles of the technology deployment for a smooth integration with renewables. For this scope, energy scenarios will be developed and the studies will cover a variety of topics, ranging from economy, energy policy, climate policy, energy technologies development, energy and power systems evolution.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Assessment and mitigation of climate change impact on urban systems (CLIM-URBS)
Supervisor	Francesca da Porto
PhD Programme	GEOSCIENCES
Curriculum (if foreseen)	
Project description	The occurrence of extreme events (such as floods, landslides, and heat waves) and their impacts on social and economic systems have dramatically increased in recent years. Climate change and rapid expansion of cities are the main responsible actors for these natural risks. The aim of this project is to develop methodologies for the assessment of natural risks at urban scale, exploiting new technologies for environmental simulations and monitoring. Agent-Based Models (ABM) and Artificial intelligence techniques can play a crucial role in the processing of data from remote sensing networks and satellite images. These data will be used for calibrating and updating both the climate hazard and exposure models for urban systems. Risk assessments will be performed to quantify the impact of these events and to identify optimal mitigation strategies, evaluating their effectiveness towards climate change as well as their sustainability, within the framework of life-cycle thinking.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Deep Closed Loop Geothermal Heat Exchanger and Energy Transition by O&G Wells Reuse
Supervisor	Antonio Galgaro
PhD Programme	GEOSCIENCES
Curriculum (if foreseen)	
Project description	The project's overall aim is to analyze the potential of deep closed loop systems for heat and power energy production in sedimentary basins, evaluating the feasibility of Oil & Gas abandoned wells reuse by different deep-closed geothermal technological solutions. The research focuses on the screening of the eligible national onshore deep wells. Representative case studies will be selected considering geological, geophysical and environmental features to define the thermo-physical-mechanical and hydrogeological site conditions. The amount of geothermal and geoelectric energy, that can be produced and made available for the local community needs, will be assessed by the numerical modelling of different deep closed loop solutions for selected case studies. The project outcomes are expected to promote the energy transition towards renewables, boosting the sustainable use of geothermal energy in the circular economy and contributing to a substantial reduction of greenhouse gas emission.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Management strategies for coastal ecosystems in the face of climate change and increasing human pressure
Supervisor	Andrea D'Alpaos
PhD Programme	GEOSCIENCES
Curriculum (if foreseen)	
Project description	Coastal ecosystems (CEs) are some of the most valuable and vulnerable natural systems on Earth. CEs provide fundamental ecosystem services: they enhance biodiversity, improve water quality, support commercial fisheries, attenuate storms, and act as efficient natural carbon sinks, helping to offset CO2 emissions. CEs are currently threatened by climate changes and human interferences, their deterioration being intense and increasing worldwide. As an example, CEs of the Venice and Marano-Grado Lagoons and of the Po River Delta, were largely degraded and partially lost in the last century. The project addresses challenges to CEs through integrated and ecosystem-based approaches and instruments, such as integrated coastal management accounting for hydrodynamic, geomorphological, ecological and economic perspectives. This is a key step to build the foundations for sustainable coastal management and development, supporting socio-economic development, biodiversity and ecosystem services.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Assessing the Po River geomorphological trajectories in relation to the planned restoration measures and future climatic scenarios
Supervisor	Simone Bizzi
PhD Programme	GEOSCIENCES
Curriculum (if foreseen)	
Project description	The PNRR for Italy, generated by NGEU programme, supports an investment of € 357M to restore the Po River ('Rinaturazione dell'area Po'). This project will restore 1.5000 hectares of the river corridor by 2026, reconnecting secondary channels and improving channel and floodplain connectivity. This research project will adopt and develop network-scale sediment connectivity models, remotely sensed information (satellite and drones), and field investigations to provide an understanding of sediment transfer and related fluvial morphological processes at the scale of the entire Po system. This research project will provide novel frameworks and tools to characterize future Po River geomorphological trajectories to support the implementation (where and how) and evaluation of the planned restoration measures under present and future climatic scenarios.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	D - Tourism, Cultural heritage and Creativity industry
National Research Program PNR 2021-2027	2. Humanistic culture, creativity, social transformations, inclusion society
Project title	Biodiversity in Archaeology. Bioarchaeological approaches to the reconstruction of environmental exploitation in ancient times
Supervisor	Jacopo Bonetto
PhD Programme	HISTORY, CRITICISM AND PRESERVATION OF CULTURAL HERITAGE
Curriculum (if foreseen)	
Project description	Bioarchaeology aims to reconstruct the diachronic evolution of human adaptation to the environment. The complex interplay between the natural environment, climate and human land use has played a key role in shaping human behaviours, cultural and socio-economic systems. Paleo-environmental and archaeological findings can provide evidence about how anthropogenic actions have managed the original landscape and biodiversity in prehistory times as well as in historical ones. This research project aims to highlight and enhance how human action deeply has affected local biodiversity, through bioarchaeological approaches to human and archaeobotanical remains. The main project's goal is to acquire a scientific data-set about environmental sources to offer more in-depth knowledge about the ecological exploitation's dynamics in ancient times.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	2. Humanistic culture, creativity, social transformations, inclusion society
Project title	Cities, architecture and environmental sustainability: selection, exploitation and management of natural resources for the construction of urban centres in Roman Cisalpine
Supervisor	Caterina Previato
PhD Programme	HISTORY, CRITICISM AND PRESERVATION OF CULTURAL HERITAGE
Curriculum (if foreseen)	
Project description	The project aims at analysing the impact that the urban development and building activity that affected the urban centres of Northern Italy in the Roman age had on the territory, the landscape and the ecosystem of the region. To this end, the research includes, on the one hand, a detailed study of the construction materials used in Roman buildings and architectural complexes in a selection of cities in the region, and, on the other, the mapping of the possible supply basins of raw materials available in the territory, in order to reconstruct the dynamics of selection, exploitation and management of natural resources that characterised the Roman age and to draw possible stimuli and suggestions to be applied in similar contexts of the contemporary age. The project is characterised by a strong multidisciplinary identity, as the ancient architecture and building materials, as well as the supply basins, will be analysed both from an archaeological and archaeometrical point of view.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	D - Tourism, Cultural heritage and Creativity industry
National Research Program PNR 2021-2027	2. Humanistic culture, creativity, social transformations, inclusion society
Project title	From Columbus to Darwin: cultural and geographical discovery through musical experiences in travel accounts
Supervisor	Paola Dessì
PhD Programme	HISTORY, CRITICISM AND PRESERVATION OF CULTURAL HERITAGE
Curriculum (if foreseen)	
Project description	Ecomusicology deals with music and sounds that are still present. Using sophisticated recording techniques, it collects in the field the music and sounds of human and animal populations and ecosystems, i.e. virgin forests, that are in danger of extinction or threatened by anthropization. Similarly, the most advanced strand of Historical Musicology, which moves from the concept of cultural biodiversity valued with an inclusive and inter/multi-disciplinary approach, has developed research to preserve and enhance cultural diversity expressed in terms of human sounds and music. Moreover, it has launched a systematic survey of the sounds of extinct, forgotten, and vanquished human populations that have not handed down their endogenous musical culture in written form with notation. The aim is to reconstruct a historical map of the musical and sound traces of the peoples and places they inhabited through the texts and images of travelers in the Modern Age.
Mandatory traineeship	9 months

Thematic area National Strategy of Intelligent Specialization 2014-20	D - Tourism, Cultural heritage and Creativity industry
National Research Program PNR 2021-2027	2. Humanistic culture, creativity, social transformations, inclusion society
Project title	Craft Roman Tools. Cultural heritage protection and traditional handicraft value enhancement
Supervisor	Maria Stella Busana
PhD Programme	HISTORY, CRITICISM AND PRESERVATION OF CULTURAL HERITAGE
Curriculum (if foreseen)	
Project description	The project aims to expand the study of ancient craft instruments, through the survey of Roman tools in Northern Italy. The focus will be on artefacts which show continuity with instruments employed up to the Industrial Revolution and whose study will help to preserve traditions that survived thanks to the efficiency and environmental sustainability of the crafting methods. Ancient handicraft will also be studied through reproductions and Experimental Archaeology, so that it could be preserved ensuring a smaller environmental impact and a better understanding of the local products. The value enhancement of the ancient artefacts will be integrated with the creation of new museum experiences, merging the visualization of the finds with the tactile input of the reproductions, crafting a new bond with the community and local businesses, allowing the latter to take part in public workshops, highlighting eco-friendly management through circular economy.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	D - Tourism, Cultural heritage and Creativity industry
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	High resolution analysis of Holocene sedimentary archives: Between climate changes, evnironment, and human impact
Supervisor	Cristiano Nicosia
PhD Programme	HISTORY, CRITICISM AND PRESERVATION OF CULTURAL HERITAGE
Curriculum (if foreseen)	
Project description	The Holocene represents the last 10.000 years of the Earth's history. During this small fraction of geologic time, climate and environment changed repeatedly, and so did the impact of human activities on the landscape. The signal of climatic, environmental, and human dynamics is well recorded in several paleo-lakes, peat bogs, and wet areas of northeastern Italy. These include the Berici Hills, the Piccole Dolomiti, the lower Verona plain, and the Trentino plateau, and are the focus of this PhD project. The candidate will bring together, in an inter-disciplinary dialogue, archaeology (from excavation to landscape studies) and hard sciences (geomorphology, micromorphology, paleobotany, 14C dating). The objective is to obtain a high-resolution account of the interplay between climate change, vegetation, and human impact throughout the Holocene. This will offer a new inter-disciplinary key to understand, mitigate, and communicate the ongoing climate change.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	D - Tourism, Cultural heritage and Creativity industry
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Galanthus nivalis
Supervisor	Alberto Lanzavecchia
PhD Programme	HUMAN RIGHTS, SOCIETY, AND MULTI-LEVEL GOVERNANCE
Curriculum (if foreseen)	
Project description	Climate change challenges social and economic development in Alpine areas: increasing losses in winter tourism and increased exposure of physical assets to natural hazards. The same area faces another challenge: despite products and services pastoralists provide (landscape and cultural heritage conservation, ecosystems services provision,...), pastoral farms and herds have declined massively. Against this background, starts the research of solutions, to turn risks into opportunities, to unlock potential local development. The research needs both an asset-based analysis (on natural, cultural and business to leverage) and a social one: to match geography specifics with touristic potential, to tackle the depopulation of the highlands by embedding the social inclusion of migrants who carry a pastoralism background. Microfinance could support the implementation of an adaptation strategy designed in a multi-level governance, such as the international standard designed by the UNESCO MAB model
Mandatory traineeship	7 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Capturing CO2 and N2 from atmosphere: nitrogen fixing cyanobacteria for a sustainable industrial production of proteins
Supervisor	Eleonora Sforza
PhD Programme	INDUSTRIAL ENGINEERING
Curriculum (if foreseen)	Chemical and Environmental Engineering
Project description	The increase of world population will inevitably cause a higher demand for protein sources. Nitrogen cycle relies on industrial N2 fixation, an energy intensive process, based on fossil fuel and with strong impact on gaseous emissions. Biological nitrogen fixation by cyanobacteria appears as a more sustainable solution and can constitute a valid alternative source of protein, as well as pigments and cyanophycin, potential biobased raw materials for the industrial sector. The use of photosynthetic organisms poses interesting perspective also in the field of CO2 capture (e.g. CO2 from flue gases). The aim of this project is to increase the photoconversion efficiency of nitrogen fixing cyanobacteria, by applying LED light under optimized wavelength spectrum and irradiation regime. The optimization of nitrogen content, which reflects on protein yield, will be also targeted. Experiments will be complemented by growth modelling and industrial process simulation, then validated on pilot plant.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Advanced models for the optimization of layout, design and operation of energy systems for the mitigation of climate change
Supervisor	Andrea Lazzaretto
PhD Programme	INDUSTRIAL ENGINEERING
Curriculum (if foreseen)	Energy Engineering
Project description	The research project aims to find and evaluate a set of concrete energy actions that can help mitigate climate change. These actions will embrace different aspects: technical improvements (renewable energy technologies, storage systems, demand side management, aggregation of users), economic measures (incentives, supporting schemes, taxes on emissions) and legislative framework (enabling policies). Useful modelling tools will be developed to study existing and innovative forms of energy generation, storage and consumption at different geographical level (urban district, city, region, country). These tools will be based on optimization algorithms implementing multi-objective functions that make use of innovative objectives, such as waste minimization. The main outcome of the project will be the identification of fair decarbonizing strategies for both producers and consumers, and that promote the exploitation of local renewable sources.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	4. Digital, industry, aerospace
Project title	Design of lightweight structural components for the white goods industry by using recycled waste plastics
Supervisor	Mauro Ricotta
PhD Programme	INDUSTRIAL ENGINEERING
Curriculum (if foreseen)	Mechanical Engineering
Project description	The research program is focussed on the design for structural durability of lightweight components made of recycled plastic for the white goods industry. The use of recycled plastic in place of virgin materials heavily contributes to the circular economy and is reported to be a main goal in the white goods industry. To combine the need for lightweight household products made of recycled plastic and structural safety of the related parts a deep knowledge of the damage mechanisms must be achieved. Therefore, the research project will start from the analysis of the candidate components and the related materials consisting of polymer and filler to be processed by means of injection moulding. Mechanical testing on specimens will be performed to characterise the structural durability of materials and define a design methodology for structural durability. Eventually the design method will be validated against experimental results generated from testing real components.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Upcycling of waste glasses in novel sustainable construction materials
Supervisor	Enrico Bernardo
PhD Programme	INDUSTRIAL ENGINEERING
Curriculum (if foreseen)	Materials Engineering
Project description	Cullet from the dismantling of many glass articles cannot be conveniently recycled, especially when strict requirements on chemical purity or optical quality of products apply. The proposed research activity aims at avoiding the disposal of difficultly recycled glasses by definition of new sustainable building materials, with the support of alkali activation. Waste glasses combined with other industrial residues or alone, as in the case of glass for pharmaceutical vials, are expected to yield alumino-silicate gels, at nearly room temperature, to be used as alternative binders or as precursors for highly porous, thermally insulating ceramics, by application of thermal treatment at moderate temperature (not exceeding 800 °C). The preservation of the ecosystem (by avoided dispersion of waste) will be coupled with climate change mitigation, by avoiding the remarkable energy consumption and CO2 emissions involved in cement synthesis and brick manufacturing and promoting thermal insulation.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	OVAGA – Optimization of long-term vanadium redox flow batteries for competitive decarbonized grid applications toward green assets
Supervisor	Massimo Guarnieri
PhD Programme	INDUSTRIAL ENGINEERING
Curriculum (if foreseen)	Electrical Engineering
Project description	The project regards the development of Redox Flow Batteries to be used in smart grids powered by renewable energy sources in the framework of “green” technological and economical development. Battery energy storage is expected to expand greatly in the coming years. In recent years, Redox Flow Batteries are emerging as a promising option for stationary storage, with pilot plants above 100 MW and 400 MWh. They use liquid electrolytes circulated by means of pumps from tanks into the stack, made of several electrochemical cells.In this way they have the unique advantage among batteries that power and energy are independently sized. They also present other very competitive features, such as good round-trip efficiency (>70%), long charge/discharge cycle life (>15,000 cycles) and low levelized cost of energy (LCE= ca. 18 C€/kWh/cycles). Nevertheless, VRFB also present some weaknesses which hinder their commercial success. This project focuses at reducing them while tailoring the technology to advanced grid services (smart grids, microgrids, hybrid grids, …). The technological program will be also based on economic analyses, aiming at competitive architectures.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Improving the sustainability/reducing the environmental impact in solids processing in the pharma, food and fine chemical industry - SUSPROS
Supervisor	Paolo Canu
PhD Programme	INDUSTRIAL ENGINEERING
Curriculum (if foreseen)	Chemical and Environmental Engineering
Project description	In the pharmaceutical, fine chemicals, and food industries, reactions involving solids as are very common. Their processing involves dissolution, synthesis, crystallization, separation, and filtration. The high added value of the products of these industries has traditionally justified energy intensive or environmentally impacting processes. Traditional methodologies and processes have been historically poorly permeable to a scientific, structured approach, mainly for the variety of products and processes, but also for regulatory constraints. The process aims at improving such processes in the pharmaceutical and related industries, introducing a rational design aimed at: 1) intensifying processes, by reducing the specific use of energy per unit conversion and cycle time, and 2) minimizing the use of toxic and environmentally impacting chemicals, such as solvents. The project takes advantage of the combination of modern methods of chemical reactions engineering, based on fundamentals in kinetics, transport phenomena and thermodynamics.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Technologies and energy strategies for the production and utilization of green hydrogen in the industrial sector
Supervisor	Anna Stoppato
PhD Programme	INDUSTRIAL ENGINEERING
Curriculum (if foreseen)	Energy Engineering
Project description	The aim is to identify different scenarios to assess the energy efficiency and environmental impact of the integrated supply chain from production to use of green hydrogen in the industrial sector. Different methods will be studied and modeled for green hydrogen production (e.g., electrolysis, dark fermentation from different organic matrices, etc.), treatment, storage (both under pressure and as metal hydrides) and use as a fuel. The conversion of green hydrogen into fuels, such as biomethane, which are easy to store and transport, will also be investigated. At the end, an LCA will be carried out for the evaluation of the CED and the CF of each scenario. For some of the identified processes, measurement campaigns will be designed and conducted, aimed at obtaining primary data to build models for the evaluation of energy efficiency and process optimization. The other data will be obtained from an in-depth and critical literature survey and the use of suitable databases.
Mandatory traineeship	9 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Dest!no: Predictive integrated mobility in an urban context
Supervisor	Matteo Comin
PhD Programme	INFORMATION ENGINEERING
Curriculum (if foreseen)	Information and Communication Science and Technologies (ICT)
Project description	The aim of the project is the multifactorial optimization of urban traffic according to the trajectories of: 1. Economy and usability of historic shopping centers, municipal offices, museums, and stakeholders (banks). 2. Suggestion models for the efficiency and maximization for existing and integrated urban transport (e.g. bike sharing). These trajectories should be placed in a broader perspective of a multivariate system of related functions, with constraints given by the morphology of city centers. The transversal objectives identified, subjected sustainability, are: 1. Minimization of parasitic traffic searching for parking with real-time prediction and suggestion systems. 2. Proximity marketing and gaming logics. 3. Maximization of demand for the use of public and integrated transport (bus, bike sharing). The objectives of the project will benefit from the availability of endogenous and exogenous data, to plan and suggest intelligent and sustainable alternatives to the use of city centers.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Advanced Grid-friendly Power Electronic Converters in Renewable Smart Energy Systems
Supervisor	Mattavelli Paolo
PhD Programme	INFORMATION ENGINEERING
Curriculum (if foreseen)	Information Science and Technology
Project description	The project pursues advanced power electronic (PE) solutions enabling a wide adoption of renewable sources and energy storage systems. The project develops along the two tightly linked research topics below: RT1. Wide bandwidth modulation and advanced control techniques for improved PE flexibility: the stability, responsiveness, and flexibility in accommodating goals at system level rely on advanced control and modulation techniques. The forthcoming PE-dominated electricity grids call for impelling advances from this respect, to improve modeling, reduce delays, and, in general, overcome the limitations typically affecting state-of-the-art digital control implementations. RT2. Stability improvement of PE systems: complex interactions arise when multiple PE converters are interconnected to an electricity grid. The stability of such systems can be tackled by the techniques this project aims to, like impedance shaping, on-line stability monitoring techniques, and automatic tuning based on mission profiles and operational data.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	Artificial intelligence techniques and internet-of-things to quantify the impact of personal exposure to air pollution on chronic disease progression and develop new sustainable prevention measures
Supervisor	Martina Vettoretti
PhD Programme	INFORMATION ENGINEERING
Curriculum (if foreseen)	Bioengineering
Project description	Air pollution is a major global threat for human health. The goal of this project is to leverage internet-of-things and artificial intelligence (AI) technologies to quantify and mitigate the effect of air pollution on the progression of chronic diseases, such as respiratory, metabolic and neurodegenerative diseases. The Ph.D. student will develop an innovative monitoring infrastructure to monitor patient's key health parameters and their personal exposure to air pollution, using wearable and environmental sensors. Then, the student will analyse personal exposure data and identify environmental risk factors that affect important clinical outcomes. Finally, the student will develop new AI models to predict adverse clinical outcomes and possibly prevent them by personalized medical treatments or positive behaviour changes. The environmental data collected in the project will be made publicly available to increase citizens' awareness about air pollution and promote sustainable mobility.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Development and application of quantum technologies to precision agriculture
Supervisor	Paolo Villoresi
PhD Programme	INFORMATION ENGINEERING
Curriculum (if foreseen)	Information Science and Technology
Project description	This project aims at applying quantum technology to the agro-food chain, focusing on the secure transmission of consumption, environmental and resource data. In fact, despite the current measurement technology exploiting also IoT networks, the agro food sector is still affected by a serious issue related to the fact that market dynamics incentivizes to manage the production outside regulated channels (eg., the known problems about the origin of olives). Quantum Key Distribution is a key-enabling technology to tackle this issue, allowing to realize verification and certification systems that guarantee secure access to the data collected or processed by the IoT infrastructure, whether it is installed in the field for agricultural production or in a food processing plant. The outcome of this project may impact the way certification-bodies also evaluate the consistency of the volumes and other quantities declared by the producer.
Mandatory traineeship	12 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	A Synthetic Biology Approach for sustainable animal farming
Supervisor	Luca Schenato
PhD Programme	INFORMATION ENGINEERING
Curriculum (if foreseen)	Information Science and Technology
Project description	The use of antibiotics and food additives to improve animal farming are a today's a standard practice. This however has a great health and environmental negative impact in terms of food quality, faces waste management and most importantly the risk of spreading antibiotic resistant pathogens. This project intends to use the most advanced tools available in Synthetic Biology to create engineered probiotic bacteria as animal microbiota supplement to 1) detect potential infection at early stages, 2) limit the growth of pathogens in the animal host microbiome by impairing their communication pathways, 3) to optimize animal therapies. More specifically, at single bacteria level, the engineered bacteria will horizontally transfer a CRISPRi-based repressor for AMR-associated gene expression. At population level, the engineered bacteria will interfere with Quorum Sensing mechanisms, thus restoring sensitivity to antibiotics. This approach will both provide greener and more sustainable farming.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Sustainable management of greenhouses using NIRS-based sensor networks and AI
Supervisor	Giulia Cisotto
PhD Programme	INFORMATION ENGINEERING
Curriculum (if foreseen)	Information Science and Technology
Project description	The management of greenhouses represents a complex and dynamic task that requires high costs in terms of energy consumption and professional skills, and typically highly impacts on the environment. The sustainability of new generations of greenhouses calls for new integrated monitoring systems, which can continuously and quantitatively monitor different parameters of the plants and their environment, using smart algorithms to promptly identify health issues and adaptively actuate actions to optimize the plants growth and prevent epidemics. This project aims to prototype a system to manage smart and autonomous greenhouses where a number of NIRS-based sensors, produced by Seletech Engineering srl, are deployed to precisely and continuously retrieve information from the greenhouse. The system will take advantage of AI based models and cloud technology, and it is expected to bring greenhouses closer tosustainability, with a significant reduction of the use of fertilizers and pesticides
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Robot for Selection and sorting of industrial waste
Supervisor	Emanuele Menegatti
PhD Programme	INFORMATION ENGINEERING
Curriculum (if foreseen)	Information Science and Technology
Project description	Industrial robot manipulators are increasingly fitted with exteroceptive sensors and autonomous planning capabilities to modify their motion according to external stimuli. In this project, we propose an AI-powered robot manipulator for waste sorting. The robot will collaborate with a human operator for sorting and dismantling industrial and civil waste. The goal is to increase efficiency and lower the cost of waste separation in order to reduce the amount of waste directed to the incinerator. Machine vision techniques based on hyperspectral imaging will be coupled with deep reinforcement learning for items classification according to the item's material. Reactive motion planning techniques and markerless human motion tracking techniques will be exploited for achieving an efficient collaboration between the human and the robot. Different robot geometries will be investigated for increasing the speed and the efficiency.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	4. Digital, industry, aerospace
Project title	Development of a monitoring and alert system on the mechanical response of trees subject to extreme external forces in an urban environment - BeTrees
Supervisor	Stefano Grigolato
PhD Programme	LAND, ENVIRONMENT, RESOURCES, HEALTH
Curriculum (if foreseen)	
Project description	Sudden and uncontrolled falling trees associated with intense weather events can dramatically affect the socio-economic and public safety in the urban and high-density population area. Uncontrolled falling trees can cause public infrastructures interruption, as can be a risk for people safety. The BeTrees project involves the development of a mechanical stability monitoring system to support decisions on the maintenance of large and historical value trees along public infrastructure and reducing the risk of damage to people / property. The project will: i. identify of the characteristics of the inertial modules for measuring the behaviour of large trees; ii. set machine learning (ML) techniques at the sensor level to detect alterations in the mechanical response without post processing analyisis; iii. design the monitoring system. The project will provide prerequisites for implementing an urban monitoring system on large trees to reduce risk of tree's collapse along public infrastructure.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Plant growth-promoting endophytic fungi from forests trees: potential applications for sustainable agro-forestry systems
Supervisor	Benedetto Linaldeddu
PhD Programme	LAND, ENVIRONMENT, RESOURCES, HEALTH
Curriculum (if foreseen)	
Project description	Fungal endophytes that live inside plant tissues without causing any apparent disease symptoms are an important component of natural ecosystems. The endophytic lifestyle with the continual metabolic interactions between the microorganism and the host have a strong evolutionary impact on plants by enhancing their growth, increasing their fitness and strengthening their tolerances to pests and diseases. Endophytes can increase the growth and yield of plant by producing bioactive secondary metabolites and phytohormones. They can act as plant growth promoter fungi (PGPF). The global concern for the development of sustainable agroforestry systems has increased in recent years, and research has been performed to explore the potential of endophytic interactions in plant growth. Keeping in mind the future application of PGPF for environmentally friendly production systems, the aim of this project proposal is to select new PGPF able to promote plant growth and to control soil-borne pathogens.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Growth of agroforestry trees in real and simulated ecosystems
Supervisor	Tommaso Sitzia
PhD Programme	LAND, ENVIRONMENT, RESOURCES, HEALTH
Curriculum (if foreseen)	
Project description	Agroforestry systems provide more benefits for biodiversity and ecosystem services than conventional production systems. The research combines field methods with simulations in a growth chamber to study the pattern and intensity of development of agroforestry trees, native and non-native to Europe. The growing conditions will be controlled in terms of physical, chemical, and biological parameters, above and below the soil surface. The smart field simulator, called "Microcosmo", is patented at European level by the Group FOS and ENEA (National agency for new technologies, energy, and sustainable economic development) and marketed by Piano Green. Among the biological factors, the biodiversity of real communities will be also considered, testing the ability of the Microcosmo to reproduce it in a controlled environment. The expected results are in the development of models for the interpretation of the relationships between primary productivity, microclimate, and ecosystem processes
Mandatory traineeship	8 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Development of sustainable tannin-based bio-foams for the thermal insulation of buildings
Supervisor	Gianluca Tondi
PhD Programme	LAND, ENVIRONMENT, RESOURCES, HEALTH
Curriculum (if foreseen)	
Project description	The aim of this proposal is to develop methods for the preparation of innovative tannin-based bio-foams for the thermal insulation of buildings. The main motivations for the research are: i) Need to save energy for buildings heating and cooling; ii) Need to develop insulation materials with low-no environmental impact. At present, indeed, this market is led by polyurethanes and polystyrene based foams and their performances are not yet reachable with any sustainable alternative. Tannin-based polymers can be processed to produce completely bio-based, lightweight foams, having good fire-resistance and low thermal conductivities (λ=40-45 mW/m.K). In this PhD project the candidate will prepare innovative foams with local resources optimizing formulations and process to obtain even more attractive porous materials by adding other natural components such as polylactic acid (PLA), regenerated silk, and polyhydroxy-alkanoate (PHAs) to the formulation to reduce the typical water affinity and the stiffness of the to-date tannin foams+
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Impact of climate change on extreme precipitation in the Italian North East (EXTREMES)
Supervisor	Marco Borga
PhD Programme	LAND, ENVIRONMENT, RESOURCES, HEALTH
Curriculum (if foreseen)	
Project description	The overarching objective of the project is to quantify near (2041-2050) and far (2090-2099) future changes in extreme precipitation probability at sub-daily temporal scales over the Italian North East, with respect to the baseline (1996-2005). This will be obtained thanks to two major scientific advances. The first advance is the advent of Convection-Permitting Models (CPMs), which substantially improve the representation of precipitation at the sub-daily scales compared to the standard Regional Climate Models (RCM) and leads to a greater confidence in their projections thanks to a more realistic representation of local processes. However, due to the computational costs of these high-resolution simulations, outputs for only three time slices are available. These 10-year time series are too short to provide reliable statistics of extremes if analyzed using the traditional extreme value theory. In the project, this limitation will be overcome by exploiting a second recent advance in the field of extreme value theory, the Metastatistical Extreme Value Distribution (MEVD), which is able to provide reliable extreme event probability estimates even from short time series, as in the case of CPM outputs.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Study of the nutritional and nutraceutical properties of microgreens obtained upon aeroponic cultivation
Supervisor	Simone Vincenzi
PhD Programme	LAND, ENVIRONMENT, RESOURCES, HEALTH
Curriculum (if foreseen)	
Project description	This project aims to better investigate the role of aeroponics as an essential technology for the future not only in the agri-food sector, but also as a source of essential nutritional elements for humans. The focal point of the research will be the so-called “microgreens”, i.e. plants collected before or in correspondence with the development of the first set of true leaves. In recent years, new research has been highlighting the nutraceutical importance of microgreens as a source of nutrients. The study of the nutritional and nutraceutical properties of microgreens obtained from different botanical species with different modulations in the nutritional solutions and in the lighting, will allow to identify the growth conditions for each one capable of optimizing the yields from both a quantitative and qualitative point of view (composition of vitamins, polyphenols, proteins, nutraceutical substances), thus allowing to further increase the advantages of cultivation in aeroponics.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	3. Security for social systems
Project title	Prototyping integrated compliance programs for water pollution prevention
Supervisor	Rocco Alagna
PhD Programme	LAW
Curriculum (if foreseen)	
Project description	There's a lack of legal protection in the field of purified public water. And it's the field of one of the most heinous and effective ways of pollution, not to mention it's one of the most significant criminal actions in causing environmental damages and environmental crimes. And the law itself here fails not only in preventing but even in punishing those actions. Considering the actual and legal separation between the purification plants owners, i.e. the local public authorities, and the plants managers, i.e. the private corporations owned by the same public authorities, the first ones cannot be charged, and the second ones have a fair and clear way to defend themselves by simply claiming that the actual public owner did not allocate any fund or resource in order to fix the old plants or to buy new ones. The project aims at prototyping specific integrated compliance programs for the prevention of purified water pollution. A compliance program in which the traditional compliance programs arising from the d.lgs. n. 231/2001 will be integrated by the procedures of an environmental management system, and so in a way that implies the cooperation between different compliance officers, dealing with: the prevention of crimes, the safety of all the people involved, the internal auditing, the quality assurance, and the legal departments of the public owned enterpriseC'è un vuoto di tutela in tema di inquinamento causato dalle acque di depurazione. E si tratta della più rilevante minaccia di inquinamento ambientale, oltre che della prima causa di danni e reati ambientali. Qui il diritto fallisce sia in fase preventiva sia in fase punitiva. Infatti, data la divaricazione tra proprietari degli impianti (gli enti locali) e loro gestori (le società partecipate), i primi non vengono mai indagati e i secondi si difendono efficacemente invocando l'insufficiente stanziamento di risorse da parte dei loro soci pubblici. La ricerca ha lo scopo di elaborare uno specifico sistema organizzativo di prevenzione del rischio di inquinamento da depurazione. Un modello che dovrà integrare i protocolli organizzativi del decreto 231/2001 con quelli del sistema di gestione ambientale, in modo che organismo di vigilanza, internal auditing, responsabile sicurezza, assicurazione qualità e ufficio legale, abbiano poteri di controllo e in tema di prevenzione dell'inquinamento delle acque.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	The role of urban and territorial planning in the creation of an integrated local system of susteinable mobility
Supervisor	Alessandro Calegari
PhD Programme	LAW
Curriculum (if foreseen)	
Project description	The traditional model of urban development considers urban mobility as a dependent variable. This has generated an expensive, inefficient and highly polluting public and private transport system. Socio-economie analyzes show that public transport becomes attractive when it is capable of ensuring quick and safe connections in all conditions, offering differentiated and integrated solutions. These results can be more easily achieved by placing the issue of mobility at the center of planning procedures tor future smart cities. The research project therefore intends to study the planning experiences that, in ltaly and abroad, have made it possible to improve urban mobility and make it more sustainable, to identify and analyze the legal solutions underlying it (prescriptions, constraints, directives, incentives, agreements, concessions, etc.), in arder to put forward effective proposals tor the reform of current legislation. Il tradizionale modello di sviluppo delle città considera la mobilità urbana come una variabile dipendente. Questo ha generato un sistema di trasporto pubblico e privato costoso, poco efficiente e molto inquinante. Le analisi socio-economiche dimostrano che il trasporto pubblico diventa attrattivo quando è capace di assicurare in ogni condizione collegamenti rapidi e sicuri, offrendo soluzioni differenziate e integrate. Questi risultati possono essere più facilmente raggiunti ponendo il tema della mobilità al centro della pianificazione delle future città intelligenti. Il progetto di ricerca intende pertanto studiare le esperienze di pianificazione che, in Italia e all'estero, hanno consentito di migliorare la mobilità urbana e renderla più sostenibile, per individuare e analizzare le soluzioni giuridiche che ne stanno alla base (prescrizioni, vincoli, direttive, incentivi, accordi, concessioni, ecc.), al fine di avanzare delle efficaci proposte di riforma della legislazione vigente.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	New business models in the building industry to preserve the ecosystem
Supervisor	Ezio Micelli
PhD Programme	MANAGEMENT ENGINEERING AND REAL ESTATE ECONOMICS
Curriculum (if foreseen)	
Project description	Following the implementation of Directive 2010/31/EU, building energy efficiency has become one of the main topics in the real estate market. Accordingly, Italian outdated properties have been forced to improve their energy performance through the installation of thermal coats, low-E windows, etc. Unfortunately, these actions have proven inadequate in achieving a satisfactory energy rating in buildings and have, at the same time, increased the gap between city's wealthy areas and disadvantaged districts. All the above being stated, this research project aims at analysing and outlining new public and private real estate redevelopment strategies, while claiming social housing as a possible solution to the issues characterizing the disadvantaged districts. The real estate redevelopment strategies analysed and defined in the research project are meant to give rise to innovative business models, which can support the adoption of the circular economy approach in the construction industry.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Sustainable logistics in the last mile: evaluation techniques
Supervisor	Chiara D'Alpaos
PhD Programme	MANAGEMENT ENGINEERING AND REAL ESTATE ECONOMICS
Curriculum (if foreseen)	
Project description	In the e-commerce and digitalization era, urban and freight logistics are becoming more costly and complex due to growing customers' expectations on increased delivery performance at lower costs and are negatively affecting the environment. Last-mile logistics is thus assuming a key role within the Green Deal's scope of sustainable mobility. Sustainable delivery of goods requires reducing circulating vehicles and travelled distances and boiling down manufacturing and logistics activities to the last mile. To respond to these challenges companies have to develop new business models and investment strategies performing best according to multiple dimensions (e.g., cost-effectiveness, customer satisfaction, sustainability). Stemming from innovative evaluation techniques, the project aims to provide a theoretical-methodological framework to evaluate effective last-mile solutions, accounting for companies' expectations on profit maximization and compliance to sustainable development goals.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	3. Security for social systems
Project title	Advanced numerical methods for the simulation of the consequences extreme hazards on structures and protection systems
Supervisor	Antonia Larese De Tetto
PhD Programme	MATHEMATICAL SCIENCES
Curriculum (if foreseen)	Computational mathematics
Project description	The objective of the project is the development and validation of numerical methods for multiphysics problems to study accurately the interaction between extreme natural events, such as floods, debris flows etc., with civil structures such as bridges, check dams, levees, or protections systems for mountainous slopes. We will start from the study and further development of state-of-the-art numerical techniques based on the finite element method and beyond, to simulate coupled problems in computational fluid dynamics, structural mechanics and geomechanics. This is the main research area of the scientific responsible. We will address the huge complexity of such models designing proper reduced models to get real time accurate results and to overcome their intrinsic deterministic nature. With this aim, uncertainty quantification techniques and novel machine learning approaches are needed to handle the huge amount of data obtaining the correct model parameters and controlling the errors.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	4. Digital, industry, aerospace
Project title	Reduction of energy waste in food/beverage processing
Supervisor	Fabio Marcuzzi
PhD Programme	MATHEMATICAL SCIENCES
Curriculum (if foreseen)	Computational mathematics
Project description	The green motivation: reduction of energy waste (and equivalent CO2 excess) in HORECA equipments operation, e.g. cooking and refrigeration. We will concentrate on two targets in which the partner SMACT is directly involved: beer tapping systems (EU project "NeoCooler") and the new bread production line. HORECA equipments use electric energy without constraints (no "eco-labels") and their unique target is to get the result in the shortest time. Even a little waste of food itself is not a big concern. The industrial experience says that mathematical modelling is a key ingredient to optimize machines operation. We will study numerical models, inspired by mathematical physics, that will run in real-time on low-cost embedded systems ("digital twins", a milestone of Industry 4.0) and machine-learning algorithms that predict online the energy waste from sensors measurements, using hw/fw devices developed by the UniPD spin-off SimNumerica (www.simnumerica.com) from opensource technologies.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	4. Digital, industry, aerospace
Project title	Study of new numerical approximation methods based on kernels for the shape optimization of the industrial products and waste reduction
Supervisor	Stefano De Marchi
PhD Programme	MATHEMATICAL SCIENCES
Curriculum (if foreseen)	Computational mathematics
Project description	Industry 4.0 focuses on the use of new technologies in the whole production process. Among them the improvement of the quality of the final products is seek. Information are usually collected with sensors sampling the shape of the piece allowing (big) data analysis through mathematical tools for optimizing the production (OptimShape) and to reduce the production waste (LessWaste). OptimShape+LessWaste help the environment by reducing the consumption of energy in the production process, the waste and also the reuse and reassembly. The project is then subdivided in two main parts related to the previous tasks: OptimShape and LessWaste. We propose to study innovative mathematical methods for optimal shaping design by scattered-data sampling on manifolds, as well as on 3-dimensional domains, and its numerical approximation by kernel-based methods e deep reinforcement learning, aiming to improve the trained cognitive model, Smart Prod ACTIVE of Enginsoft (which minimizes waste and defects), with new sensors distribution at minimal energy points or quasi-optimal points.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Optimal dispatching in intraday electricity market when storage is possible
Supervisor	Tiziano Vargiolu
PhD Programme	MATHEMATICAL SCIENCES
Curriculum (if foreseen)	Computational mathematics
Project description	The project aims to develop an optimization model to manage the dispatching activity in intraday electricity markets, where the energy of both renewable and conventional sources can be managed nearly in real time, taking into consideration the possibility to store the energy. On one hand, for a non-dispatchable renewable energy source (like e.g. photovoltaic or wind), the intraday market is the suitable trading floor to manage the more accurate forecasts available in near real time. On the other hand, the integration of energy storages into the market leads operators to make optimization choices on the management of renewable production and on the sales strategy, also taking into account the physical need of the grid and the economic impact of the trading strategy on the total revenues collected in the dispatching activity.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Electronic Power management Systems Of renewable Sources and energy storage applications (EPSOS)
Supervisor	Tommaso Caldognetto
PhD Programme	MECHATRONICS AND PRODUCT INNOVATION ENGINEERING
Curriculum (if foreseen)	
Project description	This project pursues power electronic (PE) solutions that enable an efficient conversion of electric power for electricity generation from renewable sources and energy storage. This is achieved by PE systems with advanced conversion hardware and control algorithms. The project is expected to develop along two lines of research (RL): RL1: PE conversion circuits and systems for efficient power-processing and integration of multiple resources. Promising conversion architectures and circuits will be identified based on the state-of-the-art. Selected solutions will be first modeled and evaluated in simulation, then, an accurate design of the solutions' components, especially concerning the magnetic and switching ones, will be carried out. Characterization campaign in support to the design and the analysis may be required and included too. RL2: Advanced control solutions considering the outcomes of RL1 for optimal performance operation and exploitation of systems' modularities.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Development of vector control strategies for the control of Anophles arabiensis, major vector of malaria
Supervisor	Andrea Crisanti
PhD Programme	MOLECULAR MEDICINE
Curriculum (if foreseen)	
Project description	There is an estimated 3.500 species of mosquitoes, of which over 800 are present in Africa, however only three species alone are responsible for 95% of malaria cases, a disease that leads to more than 400.000 deaths per year. The insurgence of resistance to drugs and insecticides has prompted the scientific community towards investigating the entomology, biology and genetics of these mosquitoes. A 2018 study published on “Nature biotechnology” demonstrated that a genetic modification that targets the female isoform of the doublesex gene leads to complete female sterility in Anopheles gambiae mosquitoes. The “Gene Drive” associated with this technology caused a quick spread of this modification through the caged mosquito populations in the lab, ultimately causing their decline in less than 12 generations. Anopheles gambiae is just one of the three major vectors of malaria. The research project we suggest here aims at developing a “Gene Drive System” in the Anopheles arabiensis species, another major vector of malaria in Africa. Such technologies are cost-effective, self-sustaining and species-specific, representing a great advantage towards the conservation of the environment and other insect species, which are often put at risk due to the large-scale use of insecticides.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Identification of gene candidates for the development of Gene Drive systems in Anophles gambiae, major vector of malaria
Supervisor	Andrea Crisanti
PhD Programme	MOLECULAR MEDICINE
Curriculum (if foreseen)	
Project description	Despite it being a preventable disease, more than 200 million people per year are infected with malaria, of which almost 400.000 die. Traditional methods such as insecticide-treated nets and indoor and outdoor residual spraying, combined with the development of antimalarial drugs, have determined a significant decline in the incidence of this disease in the past decades. However, since 2015 a plateau was reached in the transmission curve, due to the development of resistance to drugs and insecticides. Technologies based on genetic engineering have been recently developed aiming to achieve population suppression of mosquitoes that are malaria vectors. Among these technologies, those based on “Gene Drive” are the most promising not only because of their demonstrated efficiency in controlled experiments but also because they are self-sustaining. Moreover, these technologies can be directed to target species, in contrast with the environmental damage derived from the use of pesticides. We suggest a research project that, through bioinformatics approaches and molecular platforms aims at identifying suitable genes for the development of “Gene Drive Systems” in Anopheles gambiae.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	Sustainable development: smart toolbox for biomed- macromolecules selection and validation
Supervisor	Paola Brun
PhD Programme	MOLECULAR MEDICINE
Curriculum (if foreseen)	
Project description	The project aims to achieve bio-sustainable and low environmental impact experimental models for the development of anti-inflammatory and pro-regenerative molecules, based on natural occurring polymers such as hyaluronic acid. We shall proceed: a) By focusing on a small number of safe molecules developed and selected through in silico studies to centralize the synthetic processes, minimizing the production and exposure to hazardous substances and the in vitro and/or in vivo experimentation, reducing the impact on the environment. The company will be actively involved in this phase of the PhD student's training path; b) Analyzing the effects of the small number of selected substances on 2D human celi cultures and 3D organoids, to contain or eliminate the in vivo analysis, and, subsequently, the impact on ecosystems.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Augmentation of protein function annotation coverage of metagenomic whole genome sequencing data
Supervisor	Stefano Toppo
PhD Programme	MOLECULAR MEDICINE
Curriculum (if foreseen)	
Project description	With the advent of next-generation sequencing technologies (NGS), the analysis of untreated sewage samples is getting a common practice for different purposes: metagenomic analysis of antimicrobial resistance (AMR) genes in the human population/animal production, alteration of environmental microbiome composition, control of wastewater and in general as fine control at DNA level of environmental organisms. The accumulated data are of hard interpretation and a future challenge for in deep analysis. Based on our decennial experience on protein function prediction, we propose a new working pipeline that will increase the annotation of unknown proteins from NGS metagenomic data based on new machine learning algorithms trained on data that, in the first instance, will be based on already acquired extensive collection of curated AMR genes. The application of the project will be deployed as a service for surveillance purposes in different fields as human health and environmental control
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	CC-VBD: Multi-sectorial research based on “one-health” and “eco-health” approaches to reduce the impact of climate change on the risk of vector-borne diseases
Supervisor	Luisa Barzon
PhD Programme	MOLECULAR MEDICINE
Curriculum (if foreseen)	
Project description	In recent years, European countries have implemented actions to strengthen health systems and their ability to adapt to climate change (CC), with particular emphasis to the surveillance of infectious diseases, environmental health, and the use of early warning systems. IPCC, in the 5th Assessment Report, highlighted how CC affects mosquito-borne diseases (MBD), which are used as indicator of impact, exposure and vulnerability to CC. Aims of this research are to identify the drivers influenced by CC, which have impact on the risk of MBD emergence, and to develop tools and models to evaluate the effectiveness of CC mitigation and adaptation actions in the reduction of MBD risk. The research activity will be focused on the analysis of two geographic areas very different from an environmental and ecological point of view, northern Italy and Finland, for which detailed information on MBD are available for the last ten years from the public health, veterinary and entomological sectors.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Atmospheric plasma for water reuse - PlasWARE
Supervisor	Ester Marotta
PhD Programme	MOLECULAR SCIENCES
Curriculum (if foreseen)	Chemical sciences
Project description	Water reuse is nowadays necessary for the sustainable management of Earth resources. This implies water purification from refractory bioactive organic pollutants which are not degraded in conventional treatment stages. Atmospheric plasma is an emerging green technology, characterized by in situ production of reactive species, capable of attacking and decomposing even the most recalcitrant water pollutants, such as poly- and perfluoroalkyl substances (PFAS). So far research on PFAS degradation induced by atmospheric plasma treatment has considered aqueous solutions prepared in the laboratory, in ultrapure or tap water, containing in most cases a single pollutant. The project proposes to investigate the atmospheric plasma treatment of real water samples of different origin, to study the effect of the aqueous matrix on the reaction pathways of PFAS degradation, to optimize the process kinetics, extent of mineralization and energy cost, and ultimately to promote its application.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Development of Spectroscopic methodologies for determining the electronic and structural requirements of artificial photosynthetic constructs for solar fuel production
Supervisor	Marilena Di Valentin
PhD Programme	MOLECULAR SCIENCES
Curriculum (if foreseen)	Chemical sciences
Project description	Artificial photosynthetic systems for solar fuel production are based on the modular design of molecular-based functional units and the integration of multiple chemical functions, within a unique module, capable of light absorption, energy and electron transfer, redox catalysis for water splitting. The project adopts a molecular perspective to the problems of solar energy conversion as optimization of prototype systems requires detailed information about energetic, electronic factors, photophysical behaviour, structure and topology on the whole size scale, starting from single molecules and approaching step by step the integrated devices. The knowledge of these parameters will be pursued by a combined approach based on Electron Paramagnetic Resonance coupled with optical methods and computational chemistry modelling. The rational design of complex molecular architectures, guided by this novel methodology, will be extended to technological applications of artificial photosynthesis.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Impact of new green building-system products on indoor air quality
Supervisor	Luca Cappellin
PhD Programme	MOLECULAR SCIENCES
Curriculum (if foreseen)	Chemical sciences
Project description	The increasing demand of renewable biomaterials and bio-composites in many end-uses relating to building environment faces the contradictive need to modify such materials with chemical or physical compounds and processes needed to improve their performances. Only few of them have been standardized (formaldehyde, CCA preservatives). There is a gap of knowledge of their environmental impact, especially in terms of emission of volatile organic compounds (VOCs) during their productive process and their life cycle. The proposed doctoral work will be focused on the measurement of the influence on the indoor air quality of VOC emissions from solid wood products made with the commonest thermally modified wood processes and of wood+glue panels (plywood, fiberboards, particleboards, MDFboard). Targeted analyses based on standards (EN16516, ISO16000) will be complemented by non-target techniques to discover new harmful emissions. Toxicological risk assessments will constitute a tangible outcome.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	DeveloPment Of environmentaLLy frIeNdly Acaricide for susTainable bEekeping (POLLINATE)
Supervisor	Erica Franceschinis
PhD Programme	MOLECULAR SCIENCES
Curriculum (if foreseen)	Pharmaceutical sciences
Project description	Bees play a major role in the ecosystem. Unfortunately, their population is declining worldwide, one of the major causes being the ectoparasite Varroa destructor. The battle against this mite relies on synthetic (strong) or natural (soft) acaricides. Strong acaricides are the most effective and inexpensive, but have drawbacks, as they reduce bee cognition, accumulate in bee products, and induce mite resistance. On the other hand, soft acaricides require frequent administrations as their efficacy depends on environmental conditions. This project aims to investigate new technological solutions capable of overcoming current drawbacks related to soft acaricide formulations and administration methods. Different approaches will be pursued to provide acaricide sustained release, in particular by using sol-gel derived silica polymers alone or together with biocompatible hydrogels or mechanical supports to provide the physical, structural and stabilities necessary for field application.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	Plant cell culture-based green technology for the production of innovative healthy food materials
Supervisor	Raffaella Filippini
PhD Programme	MOLECULAR SCIENCES
Curriculum (if foreseen)	Pharmaceutical sciences
Project description	The production of innovative healthy food materials from plant cell cultures affects many industries, being a sustainable alternative to conventional processes. However, several issues still hamper the manufacturability by plant materials. This project aims to set up innovative in vitro developmental processes in order to obtain food materials free from any type of pollutant and microbial contamination, with unlimited availability, planned and adaptable according to demand, and with guaranteed titre. The project will have an outstanding impact on safeguarding natural resources and biodiversity, and will let to produce high-quality herbal products also in terms of availability and sustainability. Project goals will be achieved by accurate plant selection and collection, cell culture establishment as well as activity tests. As a more translational step, scale-up, quali-quantitative standardization, and product safety/stability control will be assessed, allowing industrial applications.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Chemical valorization of lignin for a sustainable and carbon-neutral future
Supervisor	Giulia Marina Licini
PhD Programme	MOLECULAR SCIENCES
Curriculum (if foreseen)	Chemical sciences
Project description	The development of a sustainable, carbon-neutral biorefinery has emerged as a prominent scientific and engineering goal of the 21st century. Renewable biomass-based carbon sources are investigated for utility in carbon-neutral commodity chemical manufacturing. One underutilized biomaterial is lignin, mainly produced as waste by pulping industry (50-70 million tons/y) and largely used for energy production. Because of Its highly crosslinked and randomly polymerized composition its valorization is a challenge for the chemical community. The project aim is to develop new and efficient catalytic methods for lignin valorization with two aims: a. produce selectively aromatic fine chemicals via selective depolymerization and b. obtain functional bio-based materials for industrial applications, in particular additives for PVC polymerization. An efficient valorization of waste biomass will bring a tangible and important contribution to Circular Economy and carbon-neutral industrial processes.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Novel circular strategies for the recovery of fibers, pigments and monomers from textiles (Cir-Tex)
Supervisor	Silvia Gross
PhD Programme	MOLECULAR SCIENCES
Curriculum (if foreseen)	Chemical sciences
Project description	The sustainability of the supply chain of textile industry is nowadays a major concern; due to population growth there is an urgent need to establish a more responsible production of fabrics. The processes to recycle textile materials are still partially unexplored and there is a growing endeavour to foster a circular development in which fibers/fabric/pigments can be effectively recycled/reused. Moreover, the manufacturing of technical multi-fiber textiles is now widespread, making recycling even more challenging. This PhD project developed through a tight collaboration between inorganic chemistry and organic chemistry, is aimed at devising novel strategies for the recycling of textile components. Different technologies (including depolymerisation strategies enabling recovery of monomers from most complex blends) will be optimised for separation and purification of pigments and fibres, such as polyamide, polyesters, cotton, then tested to assess the retention of useful properties.
Mandatory traineeship	9 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Porous and ACtive MAterials based on Nanocarbon-organic hybrids (PACMAN)
Supervisor	Enzo Menna
PhD Programme	MOLECULAR SCIENCES
Curriculum (if foreseen)	Chemical sciences
Project description	Organic derivatives of carbon nanostructures (CNS), such as Carbon Nanotubes, Carbon Nanohorns and Graphene, will be synthetized both through conventional chemistry and innovative green approaches in collaboration with the partner company. CNS derivatives will be used as fillers in porous composites that will be characterized for their physical, chemical and mechanical properties to evaluate their possible use as active adsorbents for organic pollutants. Porosity will be afforded with both electrospun polymer nanofibers and novel supramolecular hydrogels synthesized in collaboration with Prof. M. Mba and with the University of Groningen. Functionalization will be optimized to tune the interaction of CNSs both with the matrix and with pollutants (affinity and selectivity), and most importantly to provide photocatalytic properties by means of organic dyes, enzymatic systems or inorganic nanoclusters, for the degradation of pollutants and concurrent hydrogen production.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Investigating brain mechanisms supporting attraction/repulsion responses in insects
Supervisor	Aram Megighian
PhD Programme	NEUROSCIENCE
Curriculum (if foreseen)	
Project description	The ability to move and orient in the environment (navigation), are fundamental components of the nervous responses underlying the adaptive behaviors of organisms to the environment. Use of repellent or attractive substances heavily affect insect navigation and, therefore, the adaptive responses of organisms themselves, altering nervous system function. The project aims at studying the impact of the above mentioned substances on the behavioural and nervous system responses of insects through experimental approaches that include laboratory and in open field activities. Laboratory activities , Open field activities, we intend to take advantage of the collaboration with the Entostudio Company. This company ,isat the forefront in studying the effects of pesticide and repellent substances, both in laboratory and in open field. Furthermore, they are engaged in finding alternative and ecosustainable methods for the control of harmful organisms in association with private and public authorities.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Intelligente exsoskeleton for personal mobility in agricolture (AgriExo)
Supervisor	Alessandra Del Felice
PhD Programme	NEUROSCIENCE
Curriculum (if foreseen)	
Project description	Powered lower limb exoskeletons are wearable robots that allow independent walking in people with severe gait impairments. Their main application has been limited to clinical/rehabilitation settings. This pioneering project will develop an intelligent lower limb exoskeleton for agriculture driven by an ecological human-machine interface. The project will combine neurorobotics and artificial intelligence methodologies: a novel neuro-muscular interface will predict and communicate the user's intention to walk for a more intuitive control of the exoskeleton; the exoskeleton will be equipped with a 3D camera. Thus, the exoskeleton will be not only able to anticipate user's movements rather than react to them, but also to adapt the walking pattern according to the environment in which gait occurs (e.g., stairs, presence of trees, buckets, containers), this might promote the reintegration of farmers with disability in their fields
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	4. Digital, industry, aerospace
Project title	Designing environmentally sustainable ICT-enhanced pedagogy in Higher Education
Supervisor	Monica Fedeli
PhD Programme	PEDAGOGICAL, EDUCATIONAL AND INSTRUCTIONAL SCIENCES
Curriculum (if foreseen)	Research on Inclusion, Well-being, and Sustainability in Education
Project description	Information and communication technology (ICT), has enabled the expansion of educational opportunities. The internet has fostered a more democratic and inclusive culture of exchange. With e-learning, teaching and learning can transcend space and time. ICT in education could address two of the United Nations' Sustainable Development Goals (SDGs): quality education (goal 4) and reduced inequalities (goal 10). ICT and pedagogy has the potential of making education more sustainable and equitable. But what about the third pillar of sustainability: environmental? Is ICT in higher education environmentally sustainable? How can we ensure complete sustainability of ICT-enhanced pedagogy? This research aims to investigate the environmental sustainability of ICT-enabled higher education teaching and learning practices and to provide recommendations for low-carbon higher education systems by designing more sustainable alternatives for teachers, students, and organizations.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	Development and pre-clinical testing of novel formulations containing t-resveratrol, polydatin and coenzyme Q10 with improved oral and sublingual bioavailability
Supervisor	Andrea Cignarella
PhD Programme	PHARMACOLOGICAL SCIENCES
Curriculum (if foreseen)	Pharmacology, toxicology and therapeutics
Project description	Nutraceuticals represent a promising strategy and a high-growth market in the health care field. However, the lack of strict regulation on formulative requirements highlights the serious issue of their poor bioavailability. A clear example thereof is t-resveratrol, a cardioprotective stilbene polyphenol that undergoes extensive metabolism in the intestine and liver, resulting in a bioavailability much lower than 1%. The general objective of this project is to develop novel formulative matrixes for both the oral and sublingual route with the perspective of enhancing bioavailability of t-resveratrol, polydatin and coenzyme Q10. The project will comprise a pharmaceutical technology development to be carried out at the partner company, pharmacokinetic assessment both in human epithelial cells and in a Phase 1 study as well as efficacy testing in in vitro and ex vivo models of human mature endothelium and cardiomyocytes to be carried out at the University of Padova.
Mandatory traineeship	12 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	Development of psychoactive drugs from mushrooms of the genus Psilocybe for the treatment of brain disorders
Supervisor	Stefano Comai
PhD Programme	PHARMACOLOGICAL SCIENCES
Curriculum (if foreseen)	Molecular and cellular pharmacology
Project description	Natural products are key sources of innovative pharmaceutical agents. The incidence of neurological disorders is rising worldwide, but unfortunately, we are still missing efficacious treatments. Recent studies have shown that psychedelics could be powerful medicines for brain disorders. Here, we thus aim at developing at preclinical level, compounds from mushrooms of the genus Psilocybe, particularly psilocybin and baeocystin alone or in combination, given at low and non-psychedelic doses for treating brain injuries such as stroke. Neurogenesis, synaptogenesis and anti-inflammatory activity are evocated as their possible underlying mechanisms of action. This study will allow identifying which is the best combination of psilocybin and baeocystin to induce long-lasting therapeutic effects upon the damaged brain. Thus, we will determine which fungi of the genus Psilocybe that has a high biodiversity worldwide, can be developed as a natural source of compounds for neurological disorders.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	Development of nutraceutical ingredients (plant extracts) to slow down the biological age
Supervisor	Sofia Pavanello
PhD Programme	PHARMACOLOGICAL SCIENCES
Curriculum (if foreseen)	Pharmacology, toxicology and therapeutics
Project description	In this research study, we will identify new natural food supplements, obtained from plant extracts with anti-inflammatory proprieties, that slow down biological aging. Biological aging will be evaluated by exploring the nuclear-mitochondrial axis of cellular aging and epigenetic age that will include: Leukocyte Telomere length (LTL) and telomerase; p53 expression; mtDNA copy number (mtDNAcn) and Epigenetic age (DNAmAge).The identification of suitable antiaging candidates will be performed by in vitro studies at the Mibelle research laboratory by the PhD student. Subsequently, a placebo-controlled-double blind and randomized trial with standardized food supplements, containing the selected product, will be carried out on a suitable study population (aging workers 45-55 years old). The enrollment and follow-up of the cohort and biological aging analysis will be performed at the University of Padova, in the Environmental Mutagenesis Lab. direct by Prof. Sofia Pavanello.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	Identification of implantable medical devices' microbial communities using a whole-genome shotgun sequencing method: impact on nosocomial infection risk, environmental biodiversity and therapeutic management
Supervisor	Pamela Tozzo
PhD Programme	PHARMACOLOGICAL SCIENCES
Curriculum (if foreseen)	Molecular and cellular pharmacology
Project description	Implantable devices infections are challenging to approach both from a diagnostic and therapeutic point of view since the infectious agents are often resistant to antibiotics and capable of grow in surface biofilms. Genome analysis of individual microbiota, characterization of population dynamics, and microbial community ecology may facilitate the identification of novel pathogens, the tracking of disease outbreaks, the management of hospital policy and practice to reduce nosocomial infections and the spread of antibiotic resistance. The aim of this project is to study implantable medical devices' microbial communities using a whole-genome shotgun sequencing method in order to understand how hospital environmental microbiome may influence microbial ecology in implantable devices and how patient microbiome may contribute to reduce pathogen colonization of implantable devices with novel approaches. The proposal identifies specific emerging topics of the management of a major social and health plague such as implantable devices infections increasing the knowledge of the role of microbiome in the pathophysiology of antibiotics resistance.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Accumulation and biotransformation of veterinary drugs in plants
Supervisor	Luigi Quintieri
PhD Programme	PHARMACOLOGICAL SCIENCES
Curriculum (if foreseen)	Molecular and cellular pharmacology
Project description	The project, carried out in cooperation with researchers of Department of Comparative Biomedicine and Food Science (Prof. M. Dacasto) and Department of Agronomy, Food, Natural resources, Animals and Environment (Prof. B. Ruperti) of Padua University, and the company Iridra Srl (Florence), will be aimed at evaluating the accumulation and biotransformation of veterinary drugs present in animal waste, both in plants utilized in human and/or animal nutrition and in easily cultivated and fast-growing plants potentially suitable for use in bioremediation processes. The initial studies will be based on the use of in vitro culture techniques that will allow a tight control of parameters that could affect the uptake and/or metabolism of the studied compounds (e.g. temperature, light, drug concentration in the growth substrate) by the exposed plant organ/tissue. At a later stage, the studies will be carried out on plant material from crops treated with organic fertilizers based on animal waste.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	D - Tourism, Cultural heritage and Creativity industry
National Research Program PNR 2021-2027	2. Humanistic culture, creativity, social transformations, inclusion society
Project title	Transcendental ecology: philosophical jurisprudence and digital perspectives in the ecological transition
Supervisor	Fabio Grigenti
PhD Programme	PHILOSOPHY
Curriculum (if foreseen)	
Project description	The project focuses on the topic of ecological transition - from a current model of development that is no longer environmentally sustainable to a future one that is. To our mind, it seems unthinkable nowadays to rely on decision-making mechanisms that are based on mere administrative automatisms, or operate through the production of general norms. The aim of the project is to identify a 'jurisprudential' approach, in the sense of a 'transcendental' decisional framework capable of facing and clarifying the complexity of the disputes triggered by the ecological transition. This will involve a number of entities (governments, public institutions, associations), and different types of expertise (technical, scientific, humanist). The proposed research method thus entails an analysis of specific cases of conceptual and legal dispute on the Italian and International stage. The expected outcome consists in the creation and circulation of highly-informative, open-access digital products.
Mandatory traineeship	6 to 8 months

Thematic area National Strategy of Intelligent Specialization 2014-20	D - Tourism, Cultural heritage and Creativity industry
National Research Program PNR 2021-2027	2. Humanistic culture, creativity, social transformations, inclusion society
Project title	Landscape requalification. Ontological, Phenomenological, Ethical, Aesthetical, Epistemological Issues
Supervisor	Luca Illetterati
PhD Programme	PHILOSOPHY
Curriculum (if foreseen)	
Project description	The doctoral candidate must: 1. Carry out a critical survey of the definitions of landscape requalification in the EU's regulations and Green action plans. 2. Offer in-depth ontological, conceptual, and phenomenological analyses of these definitions. 3. Provide a list of consistent definitions of landscape requalification and, consequently, investigate: a. the cultural conditions of possibility, including historical ones, of forms of requalification corresponding to these definitions; b. the cultural consequences (aesthetic, existential, ethical, etc.) each form can have on local cultures and with respect to tourist attractiveness; c. the problems each form involves from an ethical-environmental point of view. 4. Contribute to the drafting of a vademecum on landscape requalification that can be adopted at local, national, and European level, both for calls for tenders and for the implementation of related actions. The research will interact with an ongoing landscape requalification project.
Mandatory traineeship	8 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Democratizing Ecology: Nature as a Global Political Concept
Supervisor	Sandro Chignola
PhD Programme	PHILOSOPHY
Curriculum (if foreseen)	
Project description	The modern concept of nature had key political consequences on a global scale, where the Cartesian res vera justified new processes of appropriation: whilst extra-European land became the playground of commercial competition, European political thought fitted the world in the formal devices of sovereignty. This proprietary reification has been detrimental to commons and common rights in relation to the environment. COVID-19 has emphasized the unsustainability of this logic: on one side, the genome is appropriated by international patents; on the other, the spillover blurs the border between man and nature. The project, inscribed in a global history of political concepts, will focus on: 1. The modern mechanistic construction of nature; 2. The concept of “environment” (Lamarck, Darwin, Canguilhem) and biodiversity; 3. The concept of “milieu” in governmental sciences (e.g. social prophylaxis and epidemiology); 4. The limits of private law vis-à-vis the commons from an ecological perspective.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Development and test of detectors for direct reaction measurements relevant to nuclear waste transmutation
Supervisor	Francesco Recchia
PhD Programme	PHYSICS
Curriculum (if foreseen)	
Project description	Management of nuclear waste produced during past decades is of relevant concern nowadays. In recent years, a substantial worldwide research and development activity has been devoted to partitioning and transmutation technology tor reduction in high- level radioactive waste [IAEA, WAN17]. Long-lived fission products can be transmuted into stable or short-lived nuclide through (n, gamma) reaction. To design optimum pathways of the transmutation process, several nuclear reactions will have to be studied by using long-lived fission products as secondary beams produced at a facility like ISOLDE1 CERN1 Geneva or SPES, Legnare. Cross-section information is not available because of scarce availability of the isotope in pure samples. This project aims to develop indirect techniques based on neutron transfer reactions tor the evaluation of the needed cross-sections. [IAEA] IAEA Technical Reports Series No.435(2004) [WAN17] H. Wang et al., Prog. Theor. Exp. Phys., 021D01 (2017)
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	4. Digital, industry, aerospace
Project title	FLECT: Food and Log Enhanced Computed Tomography
Supervisor	Piero Giubilato
PhD Programme	PHYSICS
Curriculum (if foreseen)	
Project description	In collaboration with Microtec, we want exploiting advancements in solid state sensors to drastically improve the performance and cost effectiveness of industriai CT scanners. Benchmark applications in the food and logging industry, where Microtec is leader, indicates how cheaper/better CT systems would improve production efficiency, raw materiai usage and environmental impact in many industriai fields. We propose to develop a prototype Depleted Monolithic Active Pixel Sensor (D- MAPS) detector tailored toward industriai CT applications, to test it in a real-world CT in collaboration with Microtec, and to study its optimization with the final goal of defining a suitable set of specification for the realization of a marketable x-ray sensors for industriai CT applications. The overall project will include state-of-the-art devices comparison, sensors characterization both in laboratory facilities and on-the-field, simulations and design of novel solutions based on the gathered data.
Mandatory traineeship	12 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Designing smart membrane nanopores with selective polymeric coatings : filtration, reclamation of wastewaters and recover of waste material
Supervisor	Emanuele Locatelli
PhD Programme	PHYSICS
Curriculum (if foreseen)	
Project description	Clean, potable water is predicted to become one of the most valuable natural resources, as demand rises worldwide: developing technologies that optimize water and soil reclamation is of capitai importance in a sustainable economy. We propose a research project that, by means of advanced simulations and machine learning techniques, aims at optimizing the design of polymeric coatings in membrane nanopores far selective filtration and recovery of waste materials, following the circular industry paradigm. The project will optimize the filtration properties of membrane pores grafted with polymeric chains, functionalized to capture the inorganic as well as the organic materiai, suspended in the wastewater. Physical parameters to optimize are 1 distribution of the functionalized sites 2 grafting density and 3 chain architecture to obtain pores that are size-selective. In collaboration with Saluber S.r.l, the performance of functionalized pores will be tested against theoretical predictions.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Optofluidic sensor for a real-time detection of plastics' and polymers's contaminants in aquatic ecosystems
Supervisor	Cinzia Sada
PhD Programme	PHYSICS
Curriculum (if foreseen)	
Project description	The project aims to develop an innovative Lab on a Chip platform based on the synergy of optics and microfluidics, for the detection of plastics' and polymers' residuals (micro- and submicro-meter size) in liquids, such as marine and freshwater ecosystems. Microfluidic circuits will be fully integrated with optical components (waveguides, light-driven sorting and storage systems), both realized in hybrid biocompatible substrates, to perform spectrally resolved optical measurements of the liquid, with specific attention to contaminants that are hardly detectable by standard optical approaches, due to low refractive index contrast. A new concept of optical detection will be implemented to achieve a portable device, reducing the times and costs needed to separate, quantify and identify the contaminants. This will include the realization of virtual photo-induced electrodes, able to previde an optical tweezing of the residuals to increase the signal-to-noise ratio.
Mandatory traineeship	9 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Sustainability of Common Pool Resources
Supervisor	Samir Suweis
PhD Programme	PHYSICS
Curriculum (if foreseen)	
Project description	The sustainable use of common-pool resources (CPRs) is a major environmental governance challenge because of their risk of over-exploitation due to short-term profit-maximization. It is stili unclear what conditions allow cooperation to emerge, leading to greater long-term rewards. Unti! recently, the study of the sustainable governance of common pool resources has overlooked the feedback between user decisions and resource dynamics. In this Ph.D. we will develop an online game platform to simulate experiments where users of the same CPR decide on their individuai resource harvesting rates to maximize their rewards, which in turn depends on the state of the resource that is evolving. The platform will be developed in collaboration with Piratech, a specialized company in browser games and virtual reality, and players from all over the globe will play the Sustainability game prompting a large citizenships experiment on sustainability of CPR.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Assessing the health of forest ecosystems
Supervisor	Sandro Azaele
PhD Programme	PHYSICS
Curriculum (if foreseen)	
Project description	Forests and other wooded land cover over 43% and 36% ofthe ofthe EU's and Italy's land space, respectively. They provide food, medicines, clean water, physical and mental health, and are a natural ally in fighting against climate change. Despite our healthy future depends on resilient forests, they are under increasing strain, because of natural and anthropogenic processes. Following the EU 2030 Biodiversity Strategy it is crucial to assess quantitatively their health and possibly to predict their future ability to keep providing ecosystem services. In this project will start from the successful experience of the BIO-4 project for developing a suite of biometrie indicators for assessing the current health of wooded land in the Veneto region and in Italy. Mathematical models, inspired by ecological processes driving ecosystem dynamics across scales, will inform the evolution of such indicators and will potentially allow to formulate predictions about health dynamics of forests.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	4. Digital, industry, aerospace
Project title	Measurement and minimization of the Carbon Footprint on high performance scientific computing and implications of the ICT on the environment
Supervisor	Alberto Garfagnini
PhD Programme	PHYSICS
Curriculum (if foreseen)	
Project description	The research program to be carried out by the student will exploit the HEP1 case to analyze the current options that are available to lower the ICT2 carbon footprint (CFP), working at three levels: - computing infrastructure, by developing a model to evaluate the CFP of different computing centers, ranging from high throughput farms with commodity hardware to HPC facllities, keeping into account, in each case, the specific production mix of the electrical energy consumed. - computing architecture, by developing and then using a benchmark suite aimed at evaluating the global CFP of server architectures, characterized by different processors, clock speeds, accelerators, etc. - application architecture, by assessing the CFP of different approaches adopted for appllcation development w.r.t. suitable performance indicators. Global optimization strategies will finally be developed using Al techniques for a few important use cases and the achievable reduction of GHG emissions will be assessed.
Mandatory traineeship	8 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Innovative nano-heterostructures as multi-functional platforms for air/water purification and sustainable energy production
Supervisor	Chiara Maccato
PhD Programme	SCIENCE AND ENGINEERING OF MATERIALS AND NANOSTRUCTURES
Curriculum (if foreseen)	
Project description	Advances in green technologies enabling water/air cleaning and sustainable energy generation are a strategic mean to enable a carbon-neutral social/industrial development. In this context, the present project, coherently with the research lines developed within the target PhD course, aims at the fabrication of innovative and cost-effective nano-heterostructures as multi-functional platforms for: i) H_2O splitting (eventually from seawater), for the simultaneous H_2 production and degradation of aqueous contaminants; ii) photocatalytic removal of nitrogen oxides as primary atmospheric pollutants. Efforts will be focused on the design and engineering of supported eco-compatible systems based on carbon nitride and metal oxides (MOx; M = Mn, Fe, Co, Ni, Cu, Zn…), eventually functionalized with oxidation (co)catalysts. A controlled modulation of the system components will be aimed at exploiting their synergistic interactions to yield an improved functional behavior in the target fields.
Mandatory traineeship	7 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Fluorinated lithium salts for secondary lithium-ion batteries electrolytes
Supervisor	Vito Di Noto
PhD Programme	SCIENCE AND ENGINEERING OF MATERIALS AND NANOSTRUCTURES
Curriculum (if foreseen)	
Project description	The research activities will be initially focused to develop innovative procedures to synthesize new lithium salts comprising fluorinated moieties and exhibiting a high solubility in non-aqueous solvents (e.g., organic carbonates, ionic liquids). The fluorinated salts will be obtained by new preparation approaches, that will be designed for a facile production upscaling and industrialization. The fluorinated salts will undergo an extensive physicochemical characterization campaign to identify the most promising candidates for implementation in the electrolyte of lithium-ion secondary batteries upon dissolution in suitable non-aqueous media. The resulting electrolytes will be thoroughly characterized to determine crucial figures of merit such as the conductivity and the electrochemical stability window. The most high-performing and stable electrolytes will finally be used in the fabrication of lithium battery prototypes, which will be tested for performance and cyclability.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	E - Aerospace and defence
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Influence of metal support interaction mediated by CeO2 or ZrO2 interfacial doping on the stability and activity of carbon supported Pt nanoparticle employed as electrocatalysts for oxygen reduction reaction in proton exchange membrane fuel cell
Supervisor	Christian Durante
PhD Programme	SCIENCE AND ENGINEERING OF MATERIALS AND NANOSTRUCTURES
Curriculum (if foreseen)	
Project description	Proton exchange membrane (PEM) fuel cells have been attracting considerable attention as clean and efficient power sources for transportation and stationary applications, because they offer high energy conversion efficiency and low environmental impact. However, wide-spread commercialization is being severely limited by the sluggish kinetics of the cathode reaction, i.e., the oxygen reduction reaction (ORR), and declining performance over time due to the mechanical, chemical, and electrochemical degradation of cell components such as the catalysts (Pt nanoparticles), supports (carbonaceous materials), and polymeric membranes. These technical challenges have yet to be resolved. Among other approaches, the use of metal oxides as additives has gained attention because they provide excellent mechanical strength, corrosion resistance, and high stability under various operating conditions. The formation of an intimate interfacial structure between the Pt and metal oxide supports can not only enhance ORR activity but provide high durability in an operating solution, via the so-called strong metal-support interaction effect. In the present project, we will optimize the mesoporous carbon using ceria or zirconia nanoparticle as composite support for the Pt NPs for gaining the simultaneous enhancement of both activity and stability, not only for the electrode catalysts, but the overall PEM-FC components.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	GAlvanic wastewaters as sUStainable precursor of Silver nanoparticles ARGAN/GAUSS
Supervisor	Alessandro Martucci
PhD Programme	SCIENCE AND ENGINEERING OF MATERIALS AND NANOSTRUCTURES
Curriculum (if foreseen)	
Project description	Only 5% of heavy metals in industrial wastewaters are recycled in Europe. With GAUSS we want to demonstrate that it is possible to use hazardous industrial wastewaters as a direct source of metal precursors for the synthesis of high added-value nanomaterials. The main objective is to obtain silver nanoparticles for different application fields, directly from galvanic wastewaters while decomposing hazardous organics, like cyanides, in the resulting aqueous byproduct. A Continuous Hydrothermal Flow Synthesis process will be used for the separation and recovery of metals. It exploits the peculiar thermophysical properties of supercritical water ($T > 374$ °C and $P > 221$ bar). In particular, the massive drop of dielectric constant under these conditions ($\varepsilon_{RT}=77 \rightarrow \varepsilon_{SC}=2$) zeroes the solubility of metal ions in water, causing their immediate precipitation as a solid powder. The product speciation, oxide or metal, is then governed by the redox and pH conditions, which can be easily controlled.
Mandatory traineeship	12 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Development of sustainable electrocatalysts for green hydrogen production
Supervisor	Laura Calvillo Lamana
PhD Programme	SCIENCE AND ENGINEERING OF MATERIALS AND NANOSTRUCTURES
Curriculum (if foreseen)	
Project description	Production of green hydrogen in electrolysers from renewable energy sources without emitting CO2 is the key for the transition to a sustainable mobility system and the basis for a decarbonised economy. In this project, we aim at developing robust electrode materials for alkaline electrolysers in collaboration with the Start up Innovativa. We will work both on the improvement of existing commercial electrodes, and on the development of innovative materials aiming at going beyond the state of the art. In this sense, we will study single metal catalysts, dispersed in a carbon-nitrogen matrix, with a precise control of the coordination environment around the single atoms in order to tune their electronic properties and improve the activity and stability. A large number of physico- and electrochemical techniques (including in situ and operando ones) will be used to achieve a rational design of the electrodes. The results of the project will have a direct impact on the industrial partner.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Innovative routes for carbon dioxide capture and reconversion
Supervisor	Andrea Sartorel
PhD Programme	SCIENCE AND ENGINEERING OF MATERIALS AND NANOSTRUCTURES
Curriculum (if foreseen)	
Project description	The utilization of carbon dioxide as a raw material represents nowadays an appealing strategy in the renewable energy, organic synthesis and green chemistry fields, with potential impact in environmental remediation. Nowadays, the capture and reutilization of CO2 emitted from anthropogenic activities are mainly limited by: i) the need of collecting CO2 from exhaust fumes and ii) the inertness of CO2. This PhD project is thus focused on the following two main objectives: i) The capture and storage of CO2, through the use of both organic and inorganic materials; ii) The development of novel catalystic materials and processes for the electrochemical / photochemical conversion of CO2 into commodity chemicals, for its fixation into organic scaffolds, and for the hydrogenation of CO2 to methane (Sabatier reaction). This project merges the research lines of the supervisor on small molecule activation with the targets of the Veritas Green Propulsion Lab on CO2 capture and reconversion.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Solid-state hydrogen storage through wastes: an eco-friendly solution for energy transportation: WASTE-TO-THREASURE - WTT
Supervisor	Antonella Glisenti
PhD Programme	SCIENCE AND ENGINEERING OF MATERIALS AND NANOSTRUCTURES
Curriculum (if foreseen)	
Project description	Numerous high surface area porous materials have been proposed as H2 storage materials, but their controlled production is not easy, and up-scale is difficult. The idea is to use carbon wastes (industrial residues from water purification filters manufacture) as starting materials to reduce cost and C-footprint. To convert C-waste into H2-storing Active Carbon (HAC) purification and activation are necessary. Activation can be obtained by chemical or physical way and aims to increase the surface area and to engineer the carbon surface. Carbon doping is expected to improve H2 storage through strengthened the gas-solid interaction by introducing metal nanoparticles or heteroatoms in the carbon matrix; this makes the adsorption/desorption easier. The HAC will be the active material for H2 adsorption inside a small vessel that is usable in a light duty vehicle (the ideal for urban distribution of goods) powered by a Fuel Cell.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Circular economy for transport infrastructures: recycling waterproofing membranes to produce long-lasting asphalt materials
Supervisor	Pasetto Marco
PhD Programme	SCIENCES OF CIVIL, ENVIRONMENTAL AND ARCHITECTURAL ENGINEERING
Curriculum (if foreseen)	Materials, structures, complex systems and architecture
Project description	Bitumen is widely used in construction thanks to its waterproofing and binding qualities as well as high ductility. In this regard, bitumen-polymer membranes are the most appropriate solution for waterproofing and reinforcement of structures. Recently, the use of membranes including fabrics/grids as pavement reinforcement has also gained interest thanks to the high resistance to cracking along with waterproofing effect against water infiltration and pumping phenomena. However, end-of-life membranes as well as production and installation residues are usually transported and disposed in landfills involving significant costs and onerous operations for the environment along with the waste of the high-quality raw materials included. Given this background, the proposed research is aimed at identifying and developing recycling technologies of the above-mentioned residues into asphalt materials for transport infrastructures to enhance life cycle of the structures while improving waste recycling.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	3. Security for social systems
Project title	COmpatible and sustainable MAterials for The Eco-friendly Rehabilitation of Constructions (CoMATER)
Supervisor	Pellegrino Carlo
PhD Programme	SCIENCES OF CIVIL, ENVIRONMENTAL AND ARCHITECTURAL ENGINEERING
Curriculum (if foreseen)	Materials, structures, complex systems and architecture
Project description	In this project, the knowledge of the state-of-the-art on the use of composite materials for the strengthening of existing constructions will be extended with the use of Eco-friendly, compatible and sustainable materials. Particular attention will be dedicated to sustainability and compatibility issues to develop efficient methods to strengthen historic constructions in the perspective of their preservation and valorisation, as well as to their repair and retrofitting. Recently documents collect experimental and/or numerical studies on the use compatible/natural materials for the strengthening of historical structures. However, this study aims to investigate some unexplored aspects, as it is: the characterization of news natural strengthening materials, the use of the completely compatible mortars, the study of the structural response of strengthened components/structures and the definition of the design criterions for the strengthened existing structures with eco-friendly materials.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Innovative management of Landfill Remediation projects with the goal of reaching the Final Storage Quality
Supervisor	Raga Roberto
PhD Programme	SCIENCES OF CIVIL, ENVIRONMENTAL AND ARCHITECTURAL ENGINEERING
Curriculum (if foreseen)	Risk, vulnerability, environment, health and territory
Project description	Landfill Remediation is currently carried out by means of Landfill Mining and subsequent further disposal of the excavated waste in new landfill sectors, designed according to current legislation. However, these new landfills are going to produce gaseous and liquid emissions to be managed for a very long time. Goal of the research project is to conceive and test a novel landfill model, where waste stabilization is accelerated and emissions into the environment are minimized. The research project involves waste sampling from an old landfill where a remediation project is currently in progress, waste characterization for the assessment of residual potential emissions, the simulation in laboratory scale reactors of accelerated waste degradation in a novel landfill model. The expected results involve the definition of an innovative landfill model where both the design and the management of the landfill guarantee the reaching of the “Final Storage Quality” in a defined amount of time.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	3. Security for social systems
Project title	Countermeasures against scour around piers and abutments of existing bridges
Supervisor	Salandin Paolo
PhD Programme	SCIENCES OF CIVIL, ENVIRONMENTAL AND ARCHITECTURAL ENGINEERING
Curriculum (if foreseen)	Risk, vulnerability, environment, health and territory
Project description	Bridges are naturally exposed to erosion, and new structures are designed to resist scour throughout their entire life. Dealing with existing bridge, pier and abutment scour is one of the primary reasons of failure and the major factor that contributes to the maintenance (or replacement) costs in the world: scour countermeasures are used to prevent failure, minimizing the erosion process that affect existing bridges. Riprap is widely used to inhibit local scour at piers/abutments at existing bridges. Important advantages are: flexibility against the pressure of the river current and easy maintenance even if some individual stones are lost. Properly designed and constructed riprap can provide long-term protection if it is inspected and maintained on a periodic basis as well as after flood events. The study will mainly be developed using physical lab models to analyze the countermeasure design (particle size distribution, gradation and installation) and to define its maintenance program.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Geomechanical modelling of faults and fractures in applications of carbon storage sequestration and hydrogen underground storage
Supervisor	Massimiliano Ferronato
PhD Programme	SCIENCES OF CIVIL, ENVIRONMENTAL AND ARCHITECTURAL ENGINEERING
Curriculum (if foreseen)	Materials, structures, complex systems and architecture
Project description	Carbon storage sequestration (CSS) and hydrogen underground storage are key applications in the EU Roadmap towards the reduction of greenhouse gas emissions and the transition to efficient and clean energy resources. While the simulation of multiphase flow processes is well developed, the availability of stable and effective computational tools for the prediction of the related geomechanical effects in real-world settings is still an issue, with particular reference to the short- and long-term safety of the storage. In this project, we focus on induced or triggered fault reactivation and fracture propagation, which can give rise to seismic events and fluid leakage. The goal is to: (i) study and design stable numerical algorithms for coupled flow and fracture mechanics, (ii) implement a modular High Performance Computing simulator, and (iii) apply the computational tools for the geomechanical analysis of pilot projects of CSS and hydrogen storage.
Mandatory traineeship	9 months

Thematic area National Strategy of Intelligent Specialization 2014-20	E - Aerospace and defence
National Research Program PNR 2021-2027	4. Digital, industry, aerospace
Project title	Monitoring of light and environmental pollution using flight systems in the lower and upper atmosphere (drones and stratospheric sounding balloons)
Supervisor	Carlo Bettanini Fecia di Cossato
PhD Programme	SCIENCES, TECHNOLOGIES AND MEASUREMENTS FOR SPACE
Curriculum (if foreseen)	Sciences and Technologies for Aeronautics and Satellite Applications
Project description	The PhD project will focus on a new approach to monitor ecosystem conservation and will in detail develop models of light pollution and air pollution for Earth atmosphere integrating data available from satellite observation with direct measurements at different altitudes obtained by autonomous payloads flown on drones and stratospheric balloons. The student will oversee improved prototypes, perform test and data analysis, supported in the activity by an experienced research team; he will also undertake a 6-month company internship where he will acquire skills on the interpretation of satellite data and services on monitoring environment. The student is expected to publish at least two articles or conference proceedings paper by the end of the program; collaborations already in place with ARPAV will help in achieving knowledge transfer and maximize social and scientific impact promoting a sustainable less polluting development, improving the quality of human life.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	E - Aerospace and defence
National Research Program PNR 2021-2027	4. Digital, industry, aerospace
Project title	Additive manufacturing for the development of a sustainable aerospace industry
Supervisor	Mirco Zaccariotto
PhD Programme	SCIENCES, TECHNOLOGIES AND MEASUREMENTS FOR SPACE
Curriculum (if foreseen)	Sciences and Technologies for Aeronautics and Satellite Applications
Project description	Sustainable development of the aviation industry requires a decrease in fuel consumption keeping the same aircraft performance: structural mass reduction is crucial. The fused filament fabrication techniques with fibre-reinforced polymers open the possibility to produce plastic components that can be joined with metallic parts obtaining a hybrid polymer-metallic structure that further enhances the mass saving. Unfortunately, 3D printed parts have a complex microstructure in which porosity and defects play an important role. It is very difficult to predict their mechanical properties starting from the properties of the feedstock materials. The research aims to overcome this issue by developing a computational method exploiting various approaches (the multiscale method, the data driven strategy and the use of nonlocal theories) able to predict the mechanical properties of a 3D printed component and to study easy-debonding interfaces for an effective decommission and material recycling.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	E - Aerospace and defence
National Research Program PNR 2021-2027	4. Digital, industry, aerospace
Project title	Space debris mitigation, protection and remediation for a sustainable orbital environment
Supervisor	Francesco Branz
PhD Programme	SCIENCES, TECHNOLOGIES AND MEASUREMENTS FOR SPACE
Curriculum (if foreseen)	Sciences and Technologies for Aeronautics and Satellite Applications
Project description	Space debris pose a considerable environmental threat and will greatly influence the human activities in orbit, affecting the sustainability of space exploitation with negative effects on ecosystems. With the goal of reducing the impact of human orbital activities on the biosphere, the research project aims at developing effective solutions for space debris (a) mitigation, (b) protection and (c) remediation. The activities may span all three of these fields, specifically focusing on: (a) the minimization of space debris production and of their effects through the development of design-for-demise and passivation approaches; (b) the long-term monitoring of the debris environment for the estimation of collision risk through the modeling of debris clouds, the prediction of collision effects and the development of protective technologies; (c) the development of Active Debris Removal mission architectures and enabling technologies like autonomous robotic systems.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	E - Aerospace and defence
National Research Program PNR 2021-2027	4. Digital, industry, aerospace
Project title	Environmental monitoring by means of cubesat hyperspectral cameras
Supervisor	Giampiero Naletto
PhD Programme	SCIENCES, TECHNOLOGIES AND MEASUREMENTS FOR SPACE
Curriculum (if foreseen)	Sciences and Technologies for Aeronautics and Satellite Applications
Project description	The proposed project foresees the design of a new hyperspectral instrument, suitable to remote sensing observations of Earth vegetation on board of cubesats. We are presently realizing a prototype of a hyperspectral instrument coupled to a stereo camera, to provide simultaneous 3D and spectral data, with a design tailored for planetary exploration. In the proposed project, we will study the possibility to adapt the design of this instrument to a cubesat for monitoring the status and evolution of vegetation on Earth. In fact, hyperspectral acquisition of plants represents a well established technique for landcover classification and separation of varieties, and allows to detect biological processes over large territories. A survey realized with low cost cubesats will allow to monitor the status of the Earth vegetation and to provide indications about regions where environmental risks are higher. This instrument could also be used to monitor agriculture crops, to optimize the production.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	3. Security for social systems
Project title	Flood Detention Basins: Participation, Planning, Project Design
Supervisor	Giorgio Osti
PhD Programme	SOCIAL SCIENCES: INTERACTIONS, COMMUNICATION, CULTURAL CONSTRUCTIONS
Curriculum (if foreseen)	
Project description	The flood detention basins (FDBs) have been seen as a compromise between old hydraulic policies based on high embankments and speed water flows and radical views, aiming at greening and enlargement of floodplain plus micro water retentions measures in the urban areas. There is a parallel between the technical measures and socio-political systems. Thus, the former model is more autocratic, while the latter aims to increase stakeholders' participation. In that sense, the FDBs mix expertise and local knowledge. Social and management sciences previde several models for framing the issue. Neo-institutional and social networks approaches can give a realistic representation of planning, projecting and participation for FDBs. The research implies a map of ltalian projects, emphasising expert knowledge construction, conflicts solution and multidimensionality, that is the capacity of FDB to temperate different socio-ecological needs, like biodiversity increase and blue areas for recreation.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	E - Aerospace and defence
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Sustainability ano food choices in a post-COVID-19 society
Supervisor	Francesca Setiffi
PhD Programme	SOCIAL SCIENCES: INTERACTIONS, COMMUNICATION, CULTURAL CONSTRUCTIONS
Curriculum (if foreseen)	
Project description	The project aims to raise the awareness of primary and secondary school students and their families about responsible and sustainable food choices. Moreover, it sets the goal of orienting external communications of the partner-enterprise. To fulfill these goals, the research will develop three actions: • A criticai review of the academic literature on consumers' food choices and social and environmental sustainability in a post-Covid-19 society; • The implementation of a social research program, together with the partner- enterprise (Altromercato), to develop communicative strategies that are apt to promote connections with other firms and to stimulate students and their families to make sustainable food choices; • Based on the points above, the development of an agile handbook that could be used in primary and secondary schools for the promotion of healthy and sustainable food choices (also taking into account concerns for biodiversity).
Mandatory traineeship	8 months

Thematic area National Strategy of Intelligent Specialization 2014-20	D - Tourism, Cultural heritage and Creativity industry
National Research Program PNR 2021-2027	2. Humanistic culture, creativity, social transformations, inclusion society
Project title	Social representations of the concept of sustainable development in international cooperation
Supervisor	Arjuna Tuzzi
PhD Programme	SOCIAL SCIENCES: INTERACTIONS, COMMUNICATION, CULTURAL CONSTRUCTIONS
Curriculum (if foreseen)	
Project description	Different meanings of development merge within the so called development aid: the meaning used by humanitarian organizations, NGOs, cooperators, beneficiaries. A large corpus of texts produced by these actors (eg. project reports, publications, guidelines, materials produced by beneficiaries) represents a relevant base to gain meanings that are generateci in their interactions at different levels. By means of statistical learning and text mining methods, the project aims at comparing different perspectives, finding patterns, and achieving a social representation of the concept of development. In terms of results the project prompts a reinterpretation of development cooperation and its impact in terms of sustainability. Further outcomes from a socia! representation approach are 1) measures/indicators to support the implementation and drafting of future projects; 2) a revised narration of the impact of sustainability in reports and publications in a more robust and context-based approach.
Mandatory traineeship	9 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Statistical methods for sustainable mobility analysis
Supervisor	Manuela Cattelan
PhD Programme	STATISTICAL SCIENCES
Curriculum (if foreseen)	
Project description	The research project focuses on the paradigm of sustainable mobility and on the quantification of effective mobility according to different types of travel modes. Based on the use of various sources of geographic and geolocalizable data, such as gps data (and other telco data), car black-boxes, bluetooth sensors and so forth, models and methods for mobility analysis will be developed in different territorial contexts. Another goal is the identification of displacement clusters based on variables such as speed, trajectory, modality and sequentiality of movement. The final aims of the research include the development of new approaches for studying mobility based on statistical methods and the estimate of the impact of mobility within the Italian territory, to offer support to decisions regarding mobility that may direct the transition towards a more sustainable and less impactful mobility. On the methodological side, the research will make use of modern statistical learning approaches.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Statistical learning and prediction for production and commercialization of renewable energy
Supervisor	Bruno Scarpa
PhD Programme	STATISTICAL SCIENCES
Curriculum (if foreseen)	
Project description	For companies dealing with energy, such as Sorgenia, the quality of the predictions is a crucial aspect for the management of plants and of network and for the financial repercussions. The development of renewable energy production plants, characterized by an inevitable variability in the energy flows produced, requires good predictive tools to be used. New statistical metods for prediction are required, that adapt to the specificities of renewable energy production. We set 3 aims. 1.Develop an adaptive statistical surveillance system for the predictive maintenance of renewable plants: a.Comparison of the current performance of the system with those of a state of normal operation b.Development of adaptive surveillance tools 2.Develop models to optimize dispatching in the presence of multi-plant generation, with attention to the symbiotic relationship of solar power and energy storage 3.Develop a network model for the optimized management of prosumer's energy communities
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	A - Smart and sustainable industry, energy and environment
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Asset pricing and climate change
Supervisor	Luigi Grossi
PhD Programme	STATISTICAL SCIENCES
Curriculum (if foreseen)	
Project description	The purpose of the research is to evaluate how much the asset values depend on uncertainty related to climate change, distinguishing between transition risk and physical risk. The research project shall consider energy commodity prices, both for primary energy commodities and vectors, and listed companies, to assess how much market uncertainty depends on emission and climate change policies vs specific commodities' and companies' characteristics. For the analysis of energy commodities and energy vectors, the project shall focus on the relationships between the trend of the fundamentals (feedstock price and vectors' spot market values) and the derivatives, taking into accounts data and information on climate change and on the policies to internalize it. Companies' climate related to the listed shares, will be assessed using both structured data (such as energy intensity and efficiency, and geo-referenced climate data) and unstructured data (such as text-type data).
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	C - Digital Agenda, Smart Communities, Intelligent Mobility Systems
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Social Media Mining for food safety surveillance in Italy
Supervisor	Dario Gregori
PhD Programme	TRANSLATIONAL SPECIALISTIC MEDICINE G.B. MORGAGNI
Curriculum (if foreseen)	Biostatistics and clinic epidemiology
Project description	Climate change is one of the biggest challenges that affect food production and availability, quality, utilization, and stability of food systems. The influence on the spread of foodborne pathogens acts directly on global food safety and enhancing traditional surveillance for food safety and foodborne diseases is becoming a priority. So, the project aims to develop an automatic system for early signaling issues related to food safety in the Italian food chain using an integrated approach of big social media data (Twitter) and machine learning for surveillance on food safety. The research will be conducted to implement and validate data mining algorithms applicable to social media content in the field of syndromic surveillance; besides, a tool for the collection of suspected food safety signals will be developed. In situations like Italy, where “informal” and small size food suppliers characterized by weak or non-existent after-sales product monitoring, are common this could be crucial.
Mandatory traineeship	9 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	Crisis in past human populations: paleonutritional and paleopathological studies on climate, environmental and economie changes for future sustainable dietary models
Supervisor	Alberto Zanatta
PhD Programme	TRANSLATIONAL SPECIALISTIC MEDICINE G.B. MORGAGNI
Curriculum (if foreseen)	Cardiovascular sciences
Project description	Current climate crisis is leading to increasingly extreme environmental phenomena that impact on Iife of world's poor populations, thus resulting in rising food emergency, conflicts and migrations. However, the human response to such crisis situations in the past demonstrated sorne known resilience episodes. Given that, the current research wants to understand how past populations survived though the crisis, with the aim to recreate a social. economie and environmental sustainability model to help future people. A specific part of project will be based on study in histomorphometry of teeth and stable isotopes (C and N) for subadults weaning and mothers' diet, and dental calculus far adult diet and microbiota. The transversal use of biological, archaeological and medicai skills will be applied to a paleopathological and paleonutrition study of skeletal collections from ltalian Bronze and lron age to understand economie behavior, health status and chronic diseases of those populations.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	Innovative human bioelectronic models as alternative to animal validation for more effective cardiotoxic risk prediction and biodiversity preservation
Supervisor	Laura Iop
PhD Programme	TRANSLATIONAL SPECIALISTIC MEDICINE G.B. MORGAGNI
Curriculum (if foreseen)	Cardiovascular sciences
Project description	Several drugs were retired due to clinical cardiotoxicity, unrevealed in preclinical validation using animal models different from humans. For pharmacological testing, cardiomyocytes differentiated from human induced pluripotent stem cells (hiPS) might more efficiently mimic human (patho)physiology, but model optimization is necessary to gain mature specialized cells, recapitulation of myocardial networks, conduction system replication, and not last acute and chronic drug assessment. To avoid the unsuitable use of animals and their sufferance in in-vivo testing, this project aims to develop more efficient, pharmacological bioelectronic tools for cardiotoxicity evaluation in vitro. Bi- and three-dimensional platforms of human working myocardium and conduction system will be created with specialized hiPS-cardiomyocytes. Drug effects will be systematically analyzed at short and long term. An in-silico computational model will be developed from collected results through machine learning
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	1. Health
Project title	Acoustic environment of the classroom and children's auditory performance as a result of the Covid-19 pandemic
Supervisor	Laura Astolfi
PhD Programme	TRANSLATIONAL SPECIALISTIC MEDICINE G.B. MORGAGNI
Curriculum (if foreseen)	Clinical and traslational neurosciences
Project description	La qualità degli ambienti scolastici è essenziale per il benessere psico-fisico dei bambini, ancor più oggi in epoca di pandemia. Il rumore presente in aula rende difficoltosa la percezione uditiva e la comprensione, e condiziona gli apprendimenti degli alunni. Il progetto ha lo scopo di identificare e misurare le componenti che condizionano l'acustica delle aule delle scuole primarie del Veneto e di valutare le conseguenze percettive uditive negli alunni normoudenti e in quelli ipoacusici che utilizzano apparecchi acustici e impianti cocleari, aggravate dall'uso delle mascherine. Inoltre, in collaborazione con la azienda partner che sviluppa soluzioni per l'isolamento acustico, si intendono effettuare misure psicoacustiche e di performance uditiva in ambiente acustico simulato, al fine di individuare delle strategie di intervento per ridurre l'impatto dell'inquinamento acustico e proporre soluzioni sostenibili per migliorare la qualità dell'ambiente interno delle aule scolastiche.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	From in vitro to in field evaluation of the efficacy of different essential oil blends against poultry coccidia
Supervisor	Antonio Frangipane di Regalbono
PhD Programme	VETERINARY SCIENCES AND FOOD SAFETY
Curriculum (if foreseen)	
Project description	Prevention and control of avian coccidiosis are traditionally based on tight interventions with synthetic drugs. Over time, this approach led to the onset of resistance strains of the main pathogenic coccidian species against the most commonly used drug classes. In the public health scenario, there are wide debates on the possible development of resistance to antibiotics used in human and veterinary medicine, the dangers to human health deriving from the presence of synthetic drug residues in food, and the need to restrict the use of these drugs (especially in broilers), and to develop alternative control strategies. This project benefits from a background of several previous experiences that allowed to select the most effective essential oils individually tested by in vitro analyses. On this basis, the main purpose of this project is to select in vitro the most effective essential oils' chemical compositions, then to perform field evaluations of their effectiveness as diet supplement.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	5. Climate, energy, sustainable mobility
Project title	Strategies to mitigate climate change and anthropogenic impacts in bivalve species of commercial interest
Supervisor	Massimo Milan
PhD Programme	VETERINARY SCIENCES AND FOOD SAFETY
Curriculum (if foreseen)	
Project description	Climate change represents the most important threat for bivalve species of high economic and ecological interest. Among them, the Manila clam and the Mediterranean mussel, following heat waves and the spread of emerging pathogens, have experienced dramatic stock reductions in the Venice lagoon and Po delta river. In addition, new anthropogenic modifications (i.e. MOSE system) and emerging contaminants (e.g. new PFAS) represent new potential threats for lagoon end estuarine ecosystems. This project, through a multidisciplinary approach based on the monitoring of chemical-physical parameters and the application of innovative biochemical and molecular analyses, will study the biological responses and adaptive strategies of clams and mussels to biotic/abiotic stressors. The final goal is to propose new strategies to mitigate the negative effects of climate change and to improve bivalve shellfish aquaculture, a sector profoundly affected by the recent COVID-19 crisis.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Integrated health assessment for the conservation and management of bottlenose dolphin (Tursiops truncatus) and loggerhead sea turtle (Caretta caretta) populations in the Northern Adriatic Sea
Supervisor	Sandro Mazzariol
PhD Programme	VETERINARY SCIENCES AND FOOD SAFETY
Curriculum (if foreseen)	
Project description	Bottlenose dolphin and loggerhead sea turtle are species regularly living in the Northern Adriatic Sea where they face multiple human related threats. Being in the IUCN Red List, countries facing this basin should implement conservation plans for these species according to International Agreements. Plans should be based on the current population health status to assess how these species would benefit from conservation efforts. The candidate will implement a standardized evaluation framework integrating biomedical assessments with ecological indicators and population monitoring and modelling. Existing data on cumulative stressors will be collected also involving fishery enterprises and analyzed using new technologies (i.e. drones, artificial intelligence, biomarkers) to identify existing/potential conflicts between human activities and the two species, and possible solutions. The results will contribute to the assessment of environmental status (Directive 2008/56/EC) in marine waters.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	The ethical dimension of assisted reproductive techniques (ART) for the conservation of rare and endangered breeds
Supervisor	Barbara de Mori
PhD Programme	VETERINARY SCIENCES AND FOOD SAFETY
Curriculum (if foreseen)	
Project description	According to FAO, 17% of animal breeds worldwide are at risk of extinction. This includes Italian historically cattle, sheep and goat breeds, whose numbers have been declining over the past fifty years. Assisted reproductive technologies (ART) may help overcoming this trend, assisting in the genetical management of the remaining populations, and increasing the number of individuals at each generations. The purpose of this PhD scholarship is to investigate the ethical issues inherent to the use of ART in the preservation of endangered breeds: from issues related to animal health and welfare (following the One Health approach), to aspects related to the human dimension, up to the value that preserving these breed can have and developing ART for the conservation of biodiversity. The final goal is to assist in the process of conservation, as ethical investigation, by improving the quality and acceptability of a project involving applications of ART, will increase its chances of success.
Mandatory traineeship	6 months

Thematic area National Strategy of Intelligent Specialization 2014-20	B - Health, Nutrition, Quality of life
National Research Program PNR 2021-2027	6. Food, bioeconomy, natural resources, agriculture, environment
Project title	Predation in canids: Characterization of predatory behavior and identification of eliciting stimuli
Supervisor	Paolo Mongillo
PhD Programme	VETERINARY SCIENCES AND FOOD SAFETY
Curriculum (if foreseen)	
Project description	The project aims at providing an understanding of predation by canids, with the long term aim of improving the cohabitation of wolves and wild dogs on the one hand, and humans, farmed and companion animals on the other. The project is built around two main objectives: first, to develop a detailed ethogram of predatory behavior of canids. This entails an extensive data collection on both videos purposedly realized and obtained from YouTube. Then, behavioral testing protocols will be developed to systematically explore what characteristics of stimuli (e.g. speed, type of movement, size) elicit predatory behaviors. Such tests will be administered in controlled experimental conditions, to both dogs and wolves, also exploring consistencies and differences between species. The project represents the first systematic exploration of predatory behavior in canids, providing unprecedented knowledge, including the identification of contexts that more likely evoke predation by dogs and wolves.
Mandatory traineeship	6 months