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DI CAMERINO



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ANNEX 1 – CORSI DI DOTTORATO IN FORMA NON ASSOCIATA

LIST OF RESEARCH TOPICS

PhD Programme	Code for topic	TOPIC
Chemical and Pharmaceutical Sciences and Biotechnology	CHEMREG 1	Materiali Polimerici ad attività Antibatterica e Riparativa per Dispositivi oftalmici Avanzati: Produzione tramite Electrospinning e Applicazioni Terapeutiche [EN] Polymeric Materials with Antibacterial and Reparative Activity for Advanced Ophthalmic Devices: Production via Electrospinning and Therapeutic Applications
Computer Science and Mathematics	CSMATHREG 1	Process-Driven Intelligence: Intelligenza Artificiale e Digital Twin per Sistemi Produttivi Autonomi [EN] Process-Driven Intelligence: Artificial Intelligence and Digital Twins for Autonomous Production Systems
Legal and social sciences	LEGREG 1	GeoWood Marche – Indicazioni Geografiche, Design e Innovazione per la competitività della filiera legno-arredo marchigiana [EN] GeoWood Marche – Geographical Indications, Design and Innovation to Enhance the Competitiveness of the Marche Wood and Furniture Sector
Life and Health Sciences	LIFEREG1	Light Therapy e Malattia di Alzheimer: effetti sulla microstruttura del sonno NREM e studio clinico su biomarcatori neurofisiologici [EN] Light Therapy and Alzheimer's Disease: Effects on NREM Sleep Microstructure and a Clinical Study of Neurophysiological Biomarkers
Life and Health Sciences	LIFEREG 2	Microbiota e cervello interconnessi: strategie innovative basate su postbiotici per un invecchiamento sano e resiliente [EN] Interconnected Microbiota and Brain: Innovative Postbiotic-Based Strategies for Healthy and Resilient Aging
Physics, Earth and Materials sciences	PEMSREG 1	Compositi ecosostenibili leggeri/isolanti a base di leganti attivati alcalinamente per applicazioni nel settore delle costruzioni (ECOCOMP) [EN] Lightweight/insulating eco-sustainable composites based on alkali-activated binders for construction applications



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DESCRIPTION OF TOPICS

PhD Programme: CHEMICAL AND PHARMACEUTICAL SCIENCES AND BIOTECHNOLOGY

Curriculum: PHARMACEUTICAL, NUTRACEUTICAL AND FOOD SCIENCES

Scholarship code: CHEMREG 1

Research Topic and project:

Materiali Polimerici ad attività Antibatterica e Riparativa per Dispositivi oftalmici Avanzati: Produzione tramite Electrospinning e Applicazioni Terapeutiche

[EN] Polymeric Materials with Antibacterial and Reparative Activity for Advanced Ophthalmic Devices: Production via Electrospinning and Therapeutic Applications

Ophthalmic medical devices are polymeric materials—solid or semi-solid, sterile or non-sterile, and with or without a pharmacological substance—intended for application to the ocular or periocular area or within the ocular cavity. They include inserts, gauzes, and patches, which may or may not be biodegradable depending on the polymer used. They are employed for the prevention or treatment of glaucoma, ocular inflammation, and dry eye syndrome, and are often made from biodegradable polymers such as PLGA and cellulose derivatives.

An innovative production technique is electrospinning, which enables the creation of micro- or nanoscale fibers, resulting in materials with a high specific surface area, tunable porosity, and controlled release capabilities, alongside good adsorption properties and anatomical compatibility.

The project aims to develop new polymeric materials with intrinsic antibacterial and reparative properties for the ocular surface or periocular area, while evaluating their physicochemical characteristics and suitability for the production of ocular inserts and patches via electrospinning. These devices are intended for the protection or treatment of the eye in cases of ocular pathology.

Supervisor: Diego Romano Perinelli (diego.perinelli@unicam.it)

Co-supervisor: Luca Casettari (Università di Urbino)

Leader of the PhD Programme: Claudio Pettinari (claudio.pettinari@unicam.it)

Language of the Phd Programme: Italian/English

Main Operative site of the Phd Student: University of Camerino, Camerino (Italy)

Exclusive participation to the project for the entire duration of the scholarship is foreseen.

Duration: **3 years**

Provisional starting date: 1st November 2026



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ECTS credits (within 3 years): 180

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PhD Programme: COMPUTER SCIENCE AND MATHEMATICS

Scholarship code: CSMATHREG 1

Research Topic and project:

Process-Driven Intelligence: Intelligenza Artificiale e Digital Twin per Sistemi Produttivi Autonomi

[EN] Process-Driven Intelligence: Artificial Intelligence and Digital Twins for Autonomous Production Systems

Industrial production systems are evolving towards increasingly autonomous, data-driven models, where cyber-physical systems and human operators interact to generate heterogeneous data streams. Despite data availability, companies still struggle to turn it into actionable knowledge to understand and adapt production process behavior. This project proposes a new "Process-Driven Intelligence" paradigm for autonomous industrial systems that integrates multimodal AI, process mining, and digital twins. The goal is to develop methods and tools to interpret heterogeneous data and reconstruct process-oriented representations that support process-aware adaptation of industrial operations. The research will address topics such as automated activity recognition, predictive monitoring, anomaly detection, and operational scenario simulation, focusing on the reliability and sustainability of production systems. The project outcomes will include new methodological models, software prototypes, and guidelines designed to boost the competitiveness of companies in the Marche region's mechanical and advanced engineering sectors.

Supervisor: Barbara Re (barbara.re@unicam.it)

Leader of the PhD Programme: Emanuela Merelli (emanuela.mereli@unicam.it)

Language of the PhD Programme: Italian/English

Main Operative site of the PhD Student: University of Camerino, Camerino (Italy)

Exclusive participation to the project for the entire duration of the scholarship is foreseen.

Duration: 3 years

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PhD Programme: LEGAL AND SOCIAL SCIENCES

Curriculum: CIVIL LAW AND CONSTITUTIONAL LEGALITY

Scholarship code: LEGREG 1

Research Topic and project:

GeoWood Marche – Indicazioni Geografiche, Design e Innovazione per la competitività della filiera legno-arredo marchigiana

[EN] GeoWood Marche – Geographical Indications, Design and Innovation to Enhance the Competitiveness of the Marche Wood and Furniture Sector

The project analyses the opportunities offered by the new European system of Geographical Indications (GIs) for craft and industrial products, introduced by Regulation (EU) 2023/2411, with particular reference to products that embody the identity and distinctive heritage of the Marche region. Through an interdisciplinary approach combining legal, economic and sociological expertise, the research aims to identify products potentially eligible for GI registration, assessing their link with the territory, established reputation, and economic, social and cultural value.

The project will examine registration mechanisms, forms of protection against imitation and usurpation, national and international best practices, and the impact of GIs on business competitiveness. Particular attention will be devoted to the role of the European GI logo and to consumer perceptions, through empirical surveys involving businesses and citizens.

The project also seeks to foster knowledge transfer to the regional production system, contributing to the valorisation of local excellence, strengthening the competitiveness of SMEs, and promoting Made in Marche products.

Furthermore, the research will provide an analysis of multilevel legislative policies and regulatory frameworks, combining the study of European sources (Regulation (EU) 2023/2411), national legislation (Legislative Decree No. 51/2026), and relevant regional legislation.

Supervisor: Lucia Ruggeri (lucia.ruggeri@unicam.it)

Co-supervisor: Francesco Casale (Università di Camerino), Luca Petrelli (Università di Camerino), Giulia D'Agnone (Università di Camerino), Marco Cucculelli (Università Politecnica delle Marche), Angela Genova (Università di Urbino)

Leader of the PhD Programme: Paolo Bianchi (paolo.bianchi@unicam.it)

Language of the Phd Programme: Italian/English

Main Operative site of the Phd Student: University of Camerino, Camerino (Italy)

Exclusive participation to the project for the entire duration of the scholarship is foreseen.

Duration: **3 years**



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PhD Programme: LIFE AND HEALTH SCIENCES
Curriculum: MOLECULAR BIOLOGY AND CELLULAR BIOTECHNOLOGY

Scholarship code: LIFEREG 1

Research Topic and project:

Light Therapy e Malattia di Alzheimer: effetti sulla microstruttura del sonno NREM e studio clinico su biomarcatori neurofisiologici

[EN] Light Therapy and Alzheimer's Disease: Effects on NREM Sleep Microstructure and a Clinical Study of Neurophysiological Biomarkers

This project investigates the effects of light therapy on NREM sleep microstructure in patients with mild-to-moderate Alzheimer's disease (AD), with particular attention to infraslow oscillations associated with brain clearance mechanisms. In a longitudinal clinical study, patients with AD and healthy controls will undergo home-based polysomnography and circadian monitoring. In all participants, the effects of a personalized light therapy protocol, tailored to each individual's circadian phase, will be evaluated. The aim is to determine whether light therapy can modulate infraslow oscillations and to identify EEG biomarkers associated with treatment response. The project integrates sleep neurophysiology, chronobiology, neurology, and lighting technology, with the goal of generating evidence to support the development of personalized non-pharmacological interventions and evidence-based circadian lighting solutions for patients with AD.

Supervisor: Michele Bellesi (michele.bellesi@unicam.it)

Co-supervisor: Simona Lattanzi (Università Politecnica delle Marche)

Leader of the PhD Programme: Attilio Fabbretti (attilio.fabbretti@unicam.it)

Language of the PhD Programme: Italian/English

Main Operative site of the PhD Student: University of Camerino, Camerino (Italy)

Exclusive participation to the project for the entire duration of the scholarship is foreseen.

Duration: 3 years

Provisional starting date: 1st November 2026

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PhD Programme: LIFE AND HEALTH SCIENCES

Curriculum: NUTRITION, FOOD AND HEALTH

Scholarship code: LIFEREG 2

Research Topic and project:

Microbiota e cervello interconnessi: strategie innovative basate su postbiotici per un invecchiamento sano e resiliente

[EN] Interconnected Microbiota and Brain: Innovative Postbiotic-Based Strategies for Healthy and Resilient Aging

Alterations in the gut microbiota and the gut–brain axis contribute to pathological aging and the onset of neurodegenerative diseases. Bacterial extracellular vesicles and postbiotics can transport proteins, lipids, and nucleic acids, thereby modulating inflammation, barrier permeability, neuroimmunity, and cellular homeostasis. This project aims to elucidate the functional role of these mediators in microbiota–host communication and to assess their potential as biomodulators of nutraceutical and biotechnological interest. Microbial preparations with potential applications in the nutraceutical sector will be identified, characterized, selected, and tested in cellular and animal models, with a focus on evaluating parameters related to inflammation, stress, senescence, and endothelial/mesenchymal function. This interdisciplinary project is particularly relevant to the Marche Region, where healthy and active aging represents a strategic and social-health priority. It will generate knowledge and innovative solutions capable of being translated into health-related products and services aimed at promoting the well-being of older adults and preventing neurofunctional decline.

Supervisor: Anna Maria Eleuteri (annamaria.eleuteri@unicam.it)

Co-supervisor: Marco Malavolta (Università Politecnica delle Marche)

Leader of the PhD Programme: Attilio Fabbretti (attilio.fabbretti@unicam.it)

Language of the Phd Programme: Italian/English

Main Operative site of the Phd Student: University of Camerino, Camerino (Italy)

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PhD Programme: PHYSICS, EARTH AND MATERIALS SCIENCES

Curriculum: PHYSICAL AND CHEMICAL PROCESSES IN EARTH SYSTEMS

Scholarship code: PEMSREG 1

Research Topic and project:

Compositi ecosostenibili leggeri/isolanti a base di leganti attivati alcalinamente per applicazioni nel settore delle costruzioni (ECOCOMP)

[EN] Lightweight/insulating eco-sustainable composites based on alkali-activated binders for construction applications

This project will develop sustainable, lightweight, alkali-activated materials with thermal insulation properties. Pre-engineered mineral precursors derived from industrial by-products, along with specially optimized additives, will be used as secondary raw materials for alkali activation. Lightweight characteristics will be achieved through the use of lightweight aggregates and/or foaming processes.

The effects of various parameters—including the chemical and mineralogical composition of precursors derived from industrial by-products, the mixture composition (water/binder ratio, precursor/aggregate ratio, component particle size, and type of additives)—on the properties of the designed composites will be evaluated in terms of setting time, workability, mechanical performance, thermal insulation, and durability. This assessment aims to determine the feasibility of producing new, sustainable, insulating construction materials as alternatives to traditional ones.

The PhD candidate will spend six months at the Vrije Universiteit Brussel (VUB) within the Materials and Chemistry / Sustainable Materials Engineering laboratories, coordinated by Prof. Hubert Rahier (<https://researchportal.vub.be/en/persons/hubert-rahier>). Under the guidance of Prof. Rahier—an expert in lightweight alkali-activated materials—the candidate will optimize formulations for new sustainable, lightweight alkali-activated composites and will also collaborate with UNIVPM on the ongoing European project RECONSTRUCT. The candidate will acquire new knowledge and skills, visit international laboratories, and attend specific university courses. During the stay abroad, there will also be opportunities to conduct experiments at the ESRF synchrotron in Grenoble, specifically X-ray tomography on some of the produced samples. This will enable the candidate to gain expertise in using this technique and in processing experimental data.

Keywords: Alkali-activated materials, Geopolymerization, Waste, Industrial by-products, Lightweight mortars, Thermal insulation, Circular economy

Supervisor: Eleonora Paris (eleonora.paris@unicam.it)

Co-supervisor: Francesca Tittarelli (Università Politecnica delle Marche)

Leader of the PhD Programme: Roberto Gunnella (roberto.gunnella@unicam.it)

Language of the PhD Programme: Italian/English

Main Operative site of the PhD Student: University of Camerino, Camerino (Italy)



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