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Antropologia Culturale e Sociale /

Cultural and Social Anthropology

119R

Progetto di ricerca Research project	ENG: <i>Energizing the Social: Power, Infrastructure, and Everyday Life in the Global South</i>
Tipo/Type	Borse di Ateneo riservate a stranieri / University Scholarships reserved for foreign students
Borse/Scholarships	1
Abstract	<p>ENG: In many regions of the Global South, electricity is not merely a background utility but a volatile and highly visible force that shapes the rhythms of daily life, political belonging, and economic aspirations. Moving beyond purely techno-economic perspectives, we invite doctoral projects that investigate electricity as a socio-technical system deeply embedded in cultural practices, political ideologies, and local cosmologies. The objective is to understand how electricity fuels expectations of the future and shapes evolving ideas of development and modernity. We are interested in how electricity is "made"—through large-scale state infrastructures, small-scale development projects, NGO interventions, and grassroots community initiatives—as much as how it is "used" and "imagined" through local ethics and belief systems. Possible research paths are: the Aesthetics and Politics of Infrastructure (how the presence—or persistent absence—of power reorganizes social time, gender roles, and the materialities of home and work); Energy Justice and Transition (the socio-cultural and political consequences of "Pro-Poor" renewable energy and the localized practices associated with the "green transition"); The Experience of Precarity (the lived experience of "waiting for light" and the ways in which intermittent access creates new inequalities while reinforcing existing social hierarchies); Electrical Cosmologies and Folklore (how electricity intersects with local beliefs, ritual practices, and everyday myths). By decentering Eurocentric narratives of "seamless" infrastructure, successful projects will contribute to a deeper understanding of how the Global South is navigating the tensions between planetary environmental crises and the local desire for modern "energy citizenship".</p>
Tutor	Prof. Alice Bellagamba
Abroad period	to be defined
Specific rules	no specific rules

Business for Society
111R

Progetto di ricerca Research project	ENG: <i>Banking Intermediation Under Digital Disruption: DeFi, Emerging Risks, and Business Model Transformation</i>
Tipo / Type	Borse di Ateneo riservate a stranieri / University Scholarships reserved for foreign students
Borse/Scholarships	1
Abstract	ENG: Digital transformation through Decentralized Finance (DeFi), stablecoins, and CBDCs is unbundling banks' traditional intermediation functions. Yet existing research largely treats these developments separately, leaving limited integrated, empirical evidence on how their combined diffusion reshapes bank intermediation and the joint trade-off between inclusion benefits, cyber/operational vulnerabilities, and systemic spillovers (especially the risk of new digital exclusion that can undermine trust and stability). Main objectives: This project aims to (i) map which intermediation activities are most exposed to disintermediation or re-bundling, (ii) assess how these shifts affect banks' business models (revenue mix, governance, risk appetite, partnerships), and (iii) develop a framework to evaluate strategic responses under different risk and regulatory scenarios. Expected impact: The project will provide actionable guidance for banks and policymakers on how to innovate responsibly, ensuring that the digital transformation preserves trust and societal value without leaving vulnerable users behind.
Tutor	Prof. Paola Bongini
Abroad period	up to 12 months
Specific rules	no specific rules

Educazione nella Società Contemporanea

Education in the Contemporary Society

120R

Progetto di ricerca Research project	<p>ITA: <i>Patrimonio culturale immateriale e materiale come spazio di trasformazione socio-educativa (PROG.1)</i></p> <p>ENG: <i>Intangible and tangible cultural heritage as spaces for socio-educational transformation (PROG.1)</i></p>
Tipo/Type	Borse di Ateneo / University Scholarships
Borse/Scholarships	1
Abstract	<p>ITA: Il progetto mira a studiare e analizzare l'importanza e il ruolo che il patrimonio culturale, sia immateriale che materiale, può svolgere nei processi di innovazione culturale, educativa e sociale. Il percorso prevede la creazione di una stretta collaborazione con musei, archivi, fondazioni, luoghi culturali, educativi e scolastici, con particolare attenzione alla valorizzazione della partecipazione delle comunità coinvolte. Supportato da una solida conoscenza della teoria critica, il progetto studierà e si concentrerà sui processi di co-progettazione e co-produzione. L'area di interesse sarà il campo della trasformazione culturale, con l'obiettivo di valorizzare il patrimonio culturale, ridurre la povertà educativa, sostenere pratiche di giustizia sociale e costruire conoscenza collettiva.</p> <p>ENG: The project aims to study and analyze the importance and the role that cultural heritage, both intangible and tangible, can provide in processes of cultural, educational and social innovation. The path should include the creation of close collaboration with museums, archives, foundations, cultural, educational and school places with a focus on enhancing the participation of the communities involved. Supported by a solide knowledge of critical theory, the project will study and focus on the processes of co-design and co-production. The focus area will be on the field of cultural transformation, with the aim of enhancing cultural heritage, reducing educational poverty, supporting social justice practices, and building collective knowledge.</p>
Tutor	to be defined
Abroad period	3 months
Specific rules	no specific rules

Educazione nella Società Contemporanea
Education in the Contemporary Society
120R

Progetto di ricerca Research project	ITA: <i>Cambiamenti e potenzialità socio-educative connesse alla transizione digitale (PROG.2)</i> ENG: <i>Changes and socio-educational opportunities related to the digital transition (PROG.2)</i>
Tipo / Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse / Scholarships	2
Abstract	<p>ITA: In un momento storico in cui la pervasività delle nuove tecnologie digitali sta trasformando l'esperienza quotidiana dei singoli e delle collettività, appare necessario indagare le combinazioni variabili di limiti e opportunità che si generano all'interno dei contesti educativi. In questo scenario, i progetti di ricerca potranno riguardare tematiche emergenti nelle seguenti aree: contrasto alle disuguaglianze educative e formative; formazione di identità individuali e collettive inedite; rafforzamento dei legami sociali/reti solidali.</p> <p>ENG: In an era where the pervasive influence of new digital technologies is reshaping the daily experiences of individuals and communities, it becomes imperative to explore the diverse interplay of constraints and possibilities within educational environments. In this scenario, research projects could delve into emerging issues in the following areas: tackling inequalities in education and training; shaping new individual and collective identities; and strengthening social cohesion and solidarity networks.</p>
Tutor	to be defined
Abroad period	3 months
Specific rules	no specific rules

Fisica e Astronomia

Physics and Astronomy

113R

Progetto di ricerca Research project	ITA: <i>Circuiti integrati per applicazioni industriali (PROG.1)</i> ENG: <i>Integrated circuits for industrial applications (PROG.1)</i>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	<p>ITA: L'attività di ricerca riguarderà lo sviluppo completo di un circuito integrato per applicazioni industriali. Definita l'applicazione, si definiranno le specifiche e quindi si passerà alla progettazione, dapprima a livello architeturale (con simulazioni comportamentali che riguarderanno anche la scelta della tecnologia CMOS più idonea) e poi a livello transistor. Si passerà quindi al disegno del layout e alle simulazioni post-layout per verificare il raggiungimento delle prestazioni assegnate. Dopo la fabbricazione del prototipo, si provvederà allo sviluppo del set-up di testing e alla completa caratterizzazione del prototipo.</p> <p>ENG: The research activity will concern the complete development of an integrated circuit for industrial applications. Once the application is defined, the specifications will be established and then the design phase will begin, first at the architectural level (with behavioral simulations also covering the choice of the most suitable CMOS technology) and then at the transistor level. The process will then proceed to layout design and post-layout simulations to verify that the assigned performance targets are achieved. After the prototype is manufactured, the development of the testing setup and the complete characterization of the prototype will be carried out.</p>
Tutor	Prof. Andrea Baschirotto
Abroad period	to be defined
Specific rules	no specific rules

Fisica e Astronomia
Physics and Astronomy
113R

Progetto di ricerca Research project	<p>ITA: <i>POLOCALC: Sviluppo e caratterizzazione di calibratori volanti artificiali per polarimetria di CMB (PROG.2)</i></p> <p>ENG: <i>POLOCALC: Development and characterization of flying artificial calibrators for CMB polarimeters</i></p> <p>(PROG.2)</p>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	<p>ITA: Il/La candidato/a lavorerà, nell'ambito del progetto ERC POLOCALC, su hardware e software innovativi per calibratori volanti su droni e palloni, da utilizzare con i più avanzati polarimetri per la CMB, effettuando misure sul campo e in laboratorio delle caratteristiche delle sorgenti luminose in banda millimetrica. L'obiettivo è sviluppare metodi avanzati per la calibrazione dell'angolo di polarizzazione assoluto dei polarimetri per la CMB, per eliminare le principali fonti di sistematiche che limitano la comprensione dell'Universo. È richiesta una preparazione nell'uso e nella calibrazione di sorgenti artificiali per telescopi radio/microonde, di strumentazione di laboratorio quali analizzatori di rete vettoriali (VNA), misure di pattern di radiazione in camera anecoica, uso di strumenti CAD per stampa 3D e progettazione di circuiti elettronici, elementi di sistemi di ricostruzione d'assetto e fotogrammetria, nonché competenze di programmazione per l'automazione degli apparati e per l'analisi dei dati sperimentali.</p> <p>ENG: The candidate will work, within the ERC POLOCALC project, on innovative hardware and software for drone- and balloon-borne flying calibrators to be used with state-of-the-art CMB polarimeters, carrying out field and laboratory measurements of the properties of millimeter-wave light sources. The goal is to develop advanced methods for the calibration of the absolute polarization angle of CMB polarimeters, one of the main sources of systematic uncertainty that currently limits our understanding of the Universe. The candidate is expected to have experience in the use and calibration of artificial sources for radio/microwave telescopes, laboratory instrumentation such as vector network analyzers (VNAs), radiation pattern measurements in anechoic chambers, the use of CAD tools for 3D printing and electronic circuit design, elements of attitude reconstruction systems and photogrammetry, as well as programming skills for instrument automation and experimental data analysis.</p>
Tutor	Prof. Federico Nati
Abroad period	to be defined
Specific rules	no specific rules

Fisica e Astronomia
Physics and Astronomy
113R

Progetto di ricerca Research project	<p>ITA: <i>POLOCALC: Fisica e cosmologia attraverso segnali polarizzati della CMB calibrati con sorgenti millimetriche artificiali (PROG.3)</i></p> <p>ENG: <i>POLOCALC: Physics and cosmology through CMB polarized signals calibrated with artificial millimeter-wave sources (PROG.3)</i></p>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	<p>ITA: La/Il candidata/o lavorerà su teoria, simulazioni e analisi dei dati legate ai segnali ottenuti dalle osservazioni di CMB, quali le onde gravitazionali primordiali e la birifrangenza cosmica, con particolare attenzione alla calibrazione delle osservazioni della componente polarizzata del fondo cosmico, collegando la calibrazione dell'angolo di polarizzazione a livello strumentale ai parametri cosmologici. La/Il candidata/o contribuirà allo sviluppo delle pipeline di simulazione e analisi dati per la calibrazione dell'angolo di rotazione assoluto dei polarimetri per la CMB. Le attività includono l'analisi dei dati dei sistemi di calibrazione e dei telescopi, la modellizzazione dei processi coinvolti (con particolare attenzione alla birifrangenza cosmica), l'analisi degli spettri di potenza angolare e delle correlazioni TB/EB, e lo sviluppo di stimatori statistici dell'angolo di rotazione.</p> <p>ENG: The candidate will work on theory, simulations, and data analysis related to signals extracted from CMB observations, such as primordial gravitational waves and cosmic birefringence, with particular emphasis on the calibration of observations of the polarized component of the cosmic background, linking the instrumental-level calibration of the polarization angle to cosmological parameters. The candidate will contribute to the development of simulation and data-analysis pipelines for the calibration of the absolute rotation angle of CMB polarimeters. The activities include data analysis of calibration systems and telescopes, modelling of the relevant processes (with particular attention to cosmic birefringence), analysis of angular power spectra and TB/EB correlations, and the development of statistical estimators of the rotation angle.</p>
Tutor	Prof. Federico Nati
Abroad period	to be defined
Specific rules	no specific rules

Fisica e Astronomia
Physics and Astronomy
113R

Progetto di ricerca Research project	ITA: <i>Analisi e inferenza astrofisica dai dati di pulsar timing array (PTA) (PROG.4)</i> ENG: <i>Pulsar timing array (PTA) data analysis and astrophysical inference (PROG.4)</i>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	<p>ITA: L'obiettivo della borsa di studio è lo sviluppo e l'espansione del modello di inferenza astrofisica dai dati PTA. Il candidato espanderà il modello di PTA likelihood per includere la distribuzione della potenza del segnale nel cielo, le sorgenti individualmente risolvibili e i loro parametri. Il modello verrà testato su dati sintetici realistici e poi su i dati reali di EPTA and IPTA. Il candidato esplorerà inoltre strumenti per identificare controparti elettromagnetiche di sorgenti PTA e per performare inferenza multimessaggera.</p> <p>ENG: The goal of the fellowship is to develop and expand the astrophysical inference model from PTA data. The candidate will expand the PTA likelihood model to include the distribution of signal strength across the sky, individually resolvable sources, and their parameters. The model will be tested on realistic synthetic data and then on real EPTA and IPTA data. The candidate will also explore tools to identify electromagnetic counterparts to PTA sources to perform multimessenger astrophysical inference.</p>
Tutor	Prof. Alberto Sesana
Abroad period	to be defined
Specific rules	no specific rules

Fisica e Astronomia
Physics and Astronomy
113R

Progetto di ricerca Research project	ITA: <i>Interpretare dati in onde gravitazionali con tecniche di inferenza moderne (PROG.5)</i> ENG: <i>Interpreting gravitational-wave data with modern inference techniques (PROG.5)</i>
Tipo/Type	Borse finanziate da enti esterni / Scholarships funded by external organizations
Ente finanziatore Funding Body	Università Italo-Francese
Borse/Scholarships	1
Abstract	<p>ITA: A seguito delle prime scoperte di LIGO e Virgo, l'astronomia delle onde gravitazionali si è trasformata in un campo in rapida espansione e ricco di dati. Sono già state rilevate centinaia di mergers di oggetti compatti e i futuri strumenti—quali Einstein Telescope e LISA—promettono miglioramenti di ordini di grandezza per sensibilità e numero di eventi. Man mano che i cataloghi di onde gravitazionali crescono in dimensione e precisione, questi offrono straordinarie opportunità per sondare la fisica fondamentale, ricostruire l'astrofisica degli oggetti compatti e tracciare l'evoluzione dell'Universo. Sfruttare pienamente tale potenziale scientifico richiede una nuova generazione di modelli e metodi che siano al contempo fisicamente accurati e computazionalmente scalabili. Sempre più spesso, ciò significa combinare framework teorici con strumenti moderni di machine learning e di inferenza statistica su larga scala. In questo scenario in rapida evoluzione, il/la dottorando/a svilupperà modelli astrofisici e statistici avanzati per interpretare i dati attuali e futuri in onde gravitazionali. Questa è una posizione condivisa tra l'Università di Milano-Bicocca (Italia), sotto la supervisione del Prof. Davide Gerosa, e l'Università di Aix-Marseille (Francia), sotto la supervisione del Dr. Michele Mancarella. Si prevede che il/la candidato/a trascorra due anni a Milano e un anno a Marsiglia.</p> <p>ENG: Since the first discoveries by LIGO and Virgo, gravitational-wave astronomy has expanded into a rapidly growing, data-rich field. Hundreds of compact-object mergers have already been detected, and upcoming instruments—such as Einstein Telescope and LISA—promise orders-of-magnitude improvements in both sensitivity and event rates. As gravitational-wave catalogs grow in size and precision, they present extraordinary opportunities to probe fundamental physics, unravel the astrophysics of compact objects, and map the evolution of the Universe. Fully exploiting this scientific potential requires a new generation of models and methods that are both physically accurate and computationally scalable. Increasingly, this means combining established theoretical frameworks with modern tools such as machine learning and large-scale statistical inference. Within this rapidly evolving landscape, the PhD candidate will develop advanced astrophysical and statistical models to interpret current and future gravitational-wave data. This is a shared position between the University of Milano-Bicocca (Italy), supervised by Prof. Davide Gerosa, and the University of Aix-Marseille (France), supervised by Dr. Michele Mancarella. We foresee that the candidate will spend two years in Milan and one year in Marseille.</p>
Tutor	Prof. Davide Gerosa, UNIMIB; Dr. Michele Mancarella, Université d'Aix-Marseille
Abroad period	12 months
Specific rules	The candidate will spend two years in Milan and one year in Marseille

Informatica

Computer Science

114R

Progetto di ricerca Research project	ITA: <i>Intelligenza Artificiale e Società (PROG.1)</i> ENG: <i>Artificial Intelligence and Society (PROG.1)</i>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	3
Abstract	<p>ITA: Il progetto deve prevedere lo sviluppo di ricerche in uno dei seguenti ambiti: "Intelligenza artificiale responsabile, affidabile, sicura e interpretabile", "Intelligenza Artificiale per il miglioramento del benessere sociale e individuale". "Applicazioni dell'Intelligenza artificiale alla ricerca biomedica e alla salute", "Intelligenza Artificiale sostenibile".</p> <p>ENG: The research project must be developed within the scope of one of the following areas: "Responsible, dependable, secure and interpretable AI", "Artificial Intelligence for the improvement of the individual and social well-being". "AI Applications for Healthcare and Biomed Research", "Sustainable Artificial Intelligence"</p>
Tutor	to be defined
Abroad period	to be defined
Specific rules	no specific rules

Medicina Traslazionale e Molecolare – DIMET

Translational and Molecular Medicine – DIMET

121R

Progetto di ricerca Research project	<p>ITA: <i>Amico o nemico? Ruoli dualistici dell'IL-22 indotta dal microbiota nel carcinoma coloretale associato a colite (CAC)_FRENEMY (PROG.1)</i></p> <p>ENG: <i>Friend or Enemy? Dualistic roles of microbial-induced IL22 in colitis-associated colorectal cancer (CAC)_FRENEMY (PROG.1)</i></p>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	<p>ITA: Il carcinoma coloretale (CRC) rappresenta la seconda causa di morte per cancro in Italia e la sua incidenza è in aumento tra i giovani adulti, che mostrano anche un incremento delle diagnosi di malattie infiammatorie croniche intestinali (IBD), condizione che li espone a un rischio maggiore di sviluppare il cancro associato a colite (CAC). L'IL 22 promuove la riparazione dell'epitelio inducendo produzione di muco, proliferazione cellulare e rigenerazione, ma un'attività incontrollata può favorire la tumorigenesi intestinale. Dati preliminari mostrano un aumento dell'espressione di IL 22 e dell'infiltrazione di cellule iNKT IL 22 produttrici nei tessuti CAC, oltre a un arricchimento di <i>Odoribacter</i>, i cui metaboliti (OsCFS) inducono IL 22 in modo dipendente da AhR; la somministrazione di tali metaboliti aumenta la tumorigenesi nei topi WT ma non in quelli privi di iNKT. L'ipotesi di questo progetto è che nei pazienti con IBD in fase pre CAC, una riparazione epiteliale eccessiva mediata dalle NKT22 indotte dal microbioma possa promuovere iperproliferazione e mutazioni driver favorendo lo sviluppo del cancro. Lo studio mira a valutare il potenziale tumorigenico e la dinamica temporale della produzione di IL 22 derivata dal microbioma in pazienti con CRC e storia di IBD, con l'obiettivo di identificare bersagli terapeutici per la prevenzione del CAC. Il disegno sperimentale comprende analisi spatial omics (WP1), studio e manipolazione delle vie metaboliche microbiche che generano metaboliti IL 22 inducenti (WP2), validazione tramite organoidi e modelli murini (WP3–4). I risultati attesi includono la caratterizzazione spaziale dei profili di espressione a singola cellula, l'identificazione delle vie enzimatiche e dei trasportatori per i metaboliti IL 22 inducenti e la definizione delle dinamiche funzionali in vitro e in vivo. Questo progetto può contribuire a colmare una rilevante lacuna clinica, individuando biomarcatori e bersagli utili a comprendere il legame tra infiammazione cronica e sviluppo del cancro.</p> <p>ENG: Colorectal cancer (CRC) is a leading cause of cancer related death in Italy and is increasingly diagnosed in young adults, who also show rising incidence of inflammatory bowel diseases (IBD), which predispose them to colitis associated cancer (CAC). IL 22 promotes epithelial repair by inducing mucus production, cell proliferation, regeneration and wound healing, but uncontrolled or prolonged IL 22 activity may favor intestinal tumorigenesis. Preliminary data show elevated IL 22 expression and increased infiltration of IL 22-producing iNKT cells in CAC tissues, along with enrichment of the bacterium <i>Odoribacter</i>, whose metabolites (OsCFS) induce IL 22 production via AhR dependent mechanisms; administering these metabolites enhances tumorigenesis in WT but not iNKT deficient mice. The working hypothesis is that in IBD patients prior to CAC development, excessive microbiome induced NKT22 mediated repair may drive epithelial hyperproliferation and the emergence of oncogenic mutations. The project aims to evaluate the tumorigenic potential and temporal dynamics of microbiome derived IL 22 in CRC patients with prior IBD, identifying actionable targets to prevent malignant transformation.</p>

	<p>The study integrates spatial omics on patient samples (WP1), dissects microbial metabolic pathways producing IL 22 inducing metabolites (WP2), validates findings in patient derived organoids and murine CAC models (WP3–4). Expected outcomes include spatial single cell characterization of epithelial gene, protein and metabolomic profiles before and after tumor development, identification of enzymatic pathways and transporters generating IL 22 inducing metabolites, and elucidation of functional temporal dynamics in vitro and in vivo. This work may fill a major clinical gap by identifying biomarkers and therapeutic targets linking chronic inflammation to cancer development in high risk patients.</p>
Tutor	to be defined
Abroad period	to be defined
Specific rules	no specific rules

Medicina Traslazionale e Molecolare – DIMET
Translational and Molecular Medicine – DIMET
121R

Progetto di ricerca Research project	ITA: <i>Genetica e genomica delle malattie epatiche autoimmuni e delle lesioni epatiche indotte da farmaci (PROG.2)</i> ENG: <i>Genetics and Genomics of Autoimmune Liver Disease and Drug-Induced Liver Injury (PROG.2)</i>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	<p>ITA: Questo progetto di dottorato, inserito nel progetto FIS2 “LiverMapAI Starting Grant” presso l’Università di Milano-Bicocca, mira a chiarire l’architettura genetica delle malattie epatiche autoimmuni e del danno epatico indotto da farmaci attraverso un approccio di genomica integrativa. Il/la candidato/a guiderà l’analisi di whole-exome sequencing su circa 500 pazienti e 2.000 controlli per identificare associazioni di varianti rare alla base di sottotipologia di malattia derivati da modelli di intelligenza artificiale, applicando framework statistici e computazionali avanzati. Il progetto integra test di associazione per varianti rare, analisi su larga scala di biobanche ed elementi di genomica evolutiva. I risultati saranno combinati con dati multi-omici, inclusi spatial transcriptomics e proteomica, per migliorare l’interpretazione biologica e raffinare la classificazione delle malattie. Il/la candidato/a ideale possiede una solida formazione quantitativa, con un background in matematica, fisica, statistica, ingegneria, informatica o bioinformatica, che garantisca competenze robuste nella modellistica statistica, nell’analisi computazionale e nell’integrazione di dati ad alta dimensionalità. Nel complesso, il progetto si colloca all’intersezione tra epatologia clinica, genomica e genetica delle popolazioni, all’interno di un ambiente di ricerca altamente interdisciplinare e orientato alla computazione.</p> <p>ENG: This PhD project, embedded within the FIS2 project "LiverMapAI Starting Grant" at the University of Milano-Bicocca, aims to elucidate the genetic architecture of autoimmune liver diseases and drug-induced liver injury through integrative genomics. The candidate will lead the whole-exome sequencing analysis of approximately 500 patients and 2,000 controls to identify rare variant associations underlying AI-derived disease subphenotypes, applying advanced statistical and computational frameworks. The project integrates rare variant association testing, large-scale biobank analyses, and evolutionary genomics. Findings will be combined with multi-omics data, including spatial transcriptomics and proteomics, to enhance biological interpretation and refine disease classification. The ideal candidate has a strong quantitative background, with prior training in mathematics, physics, statistics, engineering, computer science, or bioinformatics, ensuring robust expertise in statistical modeling, computational analysis, and high-dimensional data integration. Overall, the project bridges clinical hepatology, genomics, and population genetics within a highly interdisciplinary and computationally driven research environment.</p>
Tutor	to be defined
Abroad period	to be defined
Specific rules	no specific rules

Medicina Traslazionale e Molecolare – DIMET
Translational and Molecular Medicine – DIMET
121R

Progetto di ricerca Research project	<p>ITA: <i>Ingegnerizzazione e validazione preclinica di nanovaccini biomimetici per l'immunoprevenzione e il trattamento del carcinoma mammario triplo negativo con mutazioni BRCA (PROG.3)</i></p> <p>ENG: <i>Engineering and Preclinical Validation of Biomimetic Nanovaccines for Immunoprevention and Treatment of BRCA-Mutated Triple-Negative Breast Cancer (PROG.3)</i></p>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	<p>ITA: Il carcinoma mammario triplo negativo (TNBC) associato a mutazioni dei geni BRCA rappresenta uno dei sottotipi più aggressivi e terapeuticamente complessi delle neoplasie mammarie, caratterizzato da elevati tassi di recidiva e da limitate opzioni di trattamento mirato. Questo progetto di dottorato si inserisce nel progetto BRAVE, che propone una strategia di immuno-nanomedicina di precisione volta a trasformare l'attuale paradigma terapeutico attraverso lo sviluppo di nanoparticelle lipidiche biomimetiche personalizzate (BLNPs) in grado di indurre una risposta immunitaria antitumorale duratura. Nell'ambito del progetto BRAVE, questo progetto indagherà i meccanismi immunologici alla base dell'interazione tra nanovaccini ingegnerizzati basati su lipidi ionizzabili e il sistema immunitario dell'ospite, con l'obiettivo di superare i meccanismi intrinseci di resistenza e di evasione immunitaria tipici del TNBC con mutazione BRCA. L'ipotesi centrale è che BLNPs possano potenziare la cross-presentazione dell'antigene attraverso un'efficiente fuga endosomiale, promuovendo così l'attivazione dei linfociti T citotossici ristretta alla classe I del complesso maggiore di istocompatibilità (MHC), e contemporaneamente coinvolgendo le risposte dei linfociti T helper CD4⁺ per sostenere una memoria immunologica di lunga durata. Per verificare questa ipotesi, il progetto integrerà avanzate analisi in vitro del traffico cellulare nelle cellule dendritiche con una validazione in vivo in modelli murini antigene-specifici OT-I e OT-II, che ricapitolano il panorama genetico e immunologico del carcinoma mammario ereditario. Particolare attenzione sarà dedicata alla dissezione dei percorsi di processamento intracellulare, dell'efficienza della presentazione dell'antigene, delle dinamiche di priming dei linfociti T e della formazione dei compartimenti di linfociti T della memoria. Valutando la biodistribuzione, l'attivazione immunitaria e l'efficacia protettiva a lungo termine, questa ricerca mira a validare una piattaforma di nanovaccini versatile e trasferibile alla pratica clinica, capace di funzionare non solo come strumento terapeutico adiuvante per tumori già instaurati, ma anche come intervento immunologico preventivo per individui portatori di mutazioni BRCA ad alto rischio.</p> <p>ENG: Triple-negative breast cancer (TNBC) associated with BRCA mutations represents one of the most aggressive and therapeutically challenging subtypes of breast malignancies, characterized by high recurrence rates and limited targeted treatment options. This PhD project is part of BRAVE project which proposes a precision immuno-nanomedicine strategy aimed at transforming the current therapeutic paradigm by developing personalized biomimetic lipid nanoparticles (BLNPs) capable of eliciting robust and durable anti-tumor immunity. In the context of BRAVE project, this PhD will investigate the immunological mechanisms underlying the interaction between engineered ionizable lipid-based nanovaccines and the host immune system, with the objective of overcoming the intrinsic resistance and immune evasion mechanisms typical of BRCA-mutated TNBC. The central hypothesis is that rationally designed BLNPs can enhance antigen cross-presentation through efficient endosomal escape, thereby promoting MHC class I restricted activation of cytotoxic</p>

	<p>T lymphocytes while simultaneously engaging CD4+ T-helper responses to sustain long-term immunological memory. To test this hypothesis, the project will integrate advanced in vitro cellular trafficking analyses in dendritic cells with in vivo validation in antigen-specific OT-I and OT-II murine models, that recapitulate the genetic and immunological landscape of hereditary breast cancer. Particular attention will be devoted to dissecting intracellular processing pathways, antigen presentation efficiency, T-cell priming dynamics, and the establishment of memory T-cell compartments. By evaluating biodistribution, immune activation signatures, and long-term protective efficacy, this research aims to validate a versatile and translational nanovaccine platform capable of functioning not only as an adjunct therapeutic tool for established tumors but also as a preventive immunological intervention for individuals carrying high-risk BRCA mutations.</p>
Tutor	to be defined
Abroad period	to be defined
Specific rules	no specific rules

Neuroscienze

Neuroscience

122R

Curr. Neuroscienze Cliniche - Clinical Neurosciences

Progetto di ricerca Research project	<p>ITA: <i>Biomarker basati sui principi del controllo motorio per quantificare e monitorare il recupero nella neuroriabilitazione</i></p> <p>ENG: <i>Principles of Neural Motor Control–Based Biomarkers for Quantifying and Tracking Motor Recovery in Neurorehabilitation</i></p>
Tipo/Type	Borse di Ateneo riservati a stranieri / University Scholarships reserved for foreign students
Borse/Scholarships	1
Abstract	<p>ITA: Questo progetto di dottorato affronta i limiti delle attuali misure di esito nella neuroriabilitazione, che spesso non riescono a distinguere il recupero motorio dai pattern di movimento compensatori nelle popolazioni neurologiche. Il progetto di ricerca mira a traslare valutazioni quantitative della performance motoria e della variabilità del movimento, integrando misure cinetiche e cinematiche con biomarcatori basati sulle neuroscienze per rilevare i cambiamenti nella qualità e nella stabilità del movimento. L’obiettivo è migliorare il processo decisionale clinico e il monitoraggio della riabilitazione, consentendo una valutazione più accurata e basata sui meccanismi del recupero e sull’efficacia dei trattamenti, e supportando in ultima analisi interventi riabilitativi più precisi e personalizzati.</p> <p>ENG: This PhD project addresses the limitations of current neurorehabilitation outcome measures, which often fail to differentiate true motor recovery from compensatory movement patterns in neurological populations. The proposal aims to translate quantitative assessments of motor performance and movement variability, integrating kinetic and kinematics measures with neuroscience-based biomarkers to capture changes in movement quality and stability. The proposed project aims to improve clinical decision-making and rehabilitation monitoring by enabling more accurate, mechanism-based evaluation of recovery and treatment effectiveness, ultimately supporting more precise and personalized rehabilitation interventions.</p>
Tutor	Dr. Piscitelli Daniele
Abroad period	12 months
Specific rules	no specific rules

Psicologia, Linguistica e Neuroscienze Cognitive

Psychology, Linguistics and Cognitive Neuroscience

127R

**Curr. Psicologia Sociale, Cognitiva e Clinica
Curr. Social, Cognitive, and Clinical Psychology**

<p>Progetto di ricerca Research project</p>	<p>ITA: <i>Le nuove tecnologie (realtà virtuale e aumentata, dispositivi mobili e indossabili) applicate allo studio della mente umana e del miglioramento delle interfacce uomo-macchina (PROG.1)</i></p> <p>ENG: <i>New technologies (virtual and augmented reality, mobile and wearable devices) applied to the study of the human mind and the improvement of human-machine interfaces (PROG.1)</i></p>
<p>Tipo/Type</p>	<p>Borse finanziate dal Dipartimento / Scholarships funded by the Department</p>
<p>Borse/Scholarships</p>	<p>1</p>
<p>Abstract</p>	<p>ITA: Il/la candidato/a dovrà svolgere attività di ricerca nel contesto del progetto dei dipartimenti di eccellenza (http://de2023.psico.unimib.it). In particolare, l'attività sarà svolta tramite le competenze e attrezzature dei centri MibTec (www.mibtec.it) e BicApp (www.bicapp.it). Il/la Candidato/a dovrà quindi indagare diversi aspetti del comportamento umano e dei processi psicologici all'interno di ambienti che simulino contesti di vita reale, comprendenti lavoro, gioco, emergenza, e salute, ma siano modificabili in modo controllato. L'attività di ricerca potrà inoltre riguardare lo studio del comportamento umano e dei processi psicologici nella vita reale attraverso dispositivi wearable e portable. Tale attività di ricerca potrà inoltre indagare dal punto di vista scientifico gli human factors legati all'interazione uomo-macchina. La posizione è aperta a diverse competenze nel campo dell'informatica, dell'interaction design, dell'ingegneria e delle discipline psicologiche.</p> <p>ENG: The candidate will be required to conduct research activities within the framework of the Departments of Excellence project (http://de2023.psico.unimib.it). Specifically, the research will be carried out using the expertise and equipment available at the MibTec (www.mibtec.it) and BicApp (www.bicapp.it) centers. The candidate will investigate various aspects of human behavior and psychological processes within environments that simulate real-life contexts—including work, play, emergency, and health—while allowing for controlled manipulations. Additionally, the research may involve studying human behavior and psychological processes in real-life settings using wearable and portable devices. This research activity may also explore, from a scientific perspective, human factors related to human-machine interaction. The position is open to candidates with expertise in fields such as computer science, interaction design, engineering, and psychology. The project will be developed within the domains of Social, Cognitive, Clinical, and Work and Organizational Psychology, and the disciplinary areas of the Social, Cognitive, and Clinical Psychology track.</p>
<p>Tutor</p>	<p>to be defined</p>
<p>Abroad period</p>	<p>to be defined</p>
<p>Specific rules</p>	<p>no specific rules</p>

Public Health Epidemiology, Statistics and Economics
129R

Progetto di ricerca Research project	ENG: <i>Integration of healthcare data to develop predictive cost and outcomes models based on machine learning techniques (PROG.1)</i>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	ENG: This project aims to link clinical efficacy and economic sustainability by exploring the integration of heterogeneous healthcare datasets, including electronic health records and administrative data. By leveraging advanced Machine Learning algorithms, the research focuses on developing robust predictive models to estimate patient outcomes and associated healthcare costs simultaneously. The goal is to identify high-value care pathways and detect inefficiencies in real-time. The resulting framework will provide healthcare professionals with data-driven tools to optimize resource allocation, enhance the quality of patient care, and ensure the long-term economic viability of healthcare services and systems.
Tutor	to be defined
Abroad period	to be defined
Specific rules	no specific rules

Public Health Epidemiology, Statistics and Economics
129R

Progetto di ricerca Research project	ENG: <i>Development and assessment of innovations in hospital healthcare and technological organization (PROG.2)</i>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	ENG: This research project focuses on the design and rigorous evaluation of structural and technological innovations within hospital settings. By assessing the impact of emerging technologies on patient safety and outcomes and staff productivity, the project aims to contribute to the definition of hospital framework. The ultimate objective is to establish evidence-based strategies for organizational change, ensuring that technological adoption translates into improved healthcare delivery and a more resilient hospital infrastructure.
Tutor	to be defined
Abroad period	to be defined
Specific rules	no specific rules

Scienza e Nanotecnologia dei Materiali

Materials Science and Nanotechnology

116R

Progetto di ricerca Research project	ENG: <i>2D materials for next-generation quantum sensing</i>
Tipo/Type	Borse di Ateneo riservati a stranieri / University Scholarships reserved for foreign students
Borse/Scholarships	1
Abstract	ENG: Quantum sensing technologies exploit quantum phenomena such as quantum coherence, superposition and entanglement to measure physical quantities with sensitivities that are unattainable using classical sensors. The most established material is diamond whose nitrogen-vacancy colour centers remain the benchmark platform, but several limitations related to surface noise readout efficiency, and integration into devices severely limits its application. Potentially, spin qubits in 2D materials such as hexagonal boron-nitride (hBN) can overcome these limitations opening up a new platform of materials for the next-generation quantum sensors. Main objectives are: 1. Identification and engineering of color center spin-qubits in 2D materials by Optically Detected Magnetic Resonance Spectroscopy and Microscopy. 2. Investigate the spin properties and sensing protocols for magnetic field, electric field, and temperature detection. 3. Provide the designing rules for quantum sensing optimal performance in 2D semiconductors.
Tutor	Prof. Fabrizio Moro
Abroad period	12-18 months
Specific rules	Mandatory secondment abroad at University of Stuttgart (Germany), under the supervision of Prof. Joris von Slageren.

Scienza e Nanotecnologia dei Materiali
Materials Science and Nanotechnology
116R

Progetto di ricerca Research project	ENG: <i>Modelling Smart Single-Atom Catalysts for plasma assisted activation of stable molecular systems (PROG.1)</i>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse / Scholarships	1
Abstract	ENG: This project deals with the critical issue of describing with atomistic precision catalytic processes involving the activation of stable molecular systems on single-atom catalysts (SACs). SACs are the hot frontier of catalysis research, due to the potential breakthroughs arising from the low metal loading, high dispersion, and the potential to engineer the active phase by playing with the local structure. This theoretical project will take advantage of cutting-edge quantum chemical approaches to model the role of plasma activation towards catalytic activity. The theoretical framework that will be developed will be combined also with machine learning accelerated tools to scale-up the models. The project will identify key descriptors to maximize the affinity of SACs with target molecular systems to activate and, at the same time, it will unravel the role of plasma excitation.
Tutor	Prof. Giovanni Di Liberto
Abroad period	min 6 months
Specific rules	no specific rules

Scienza e Nanotecnologia dei Materiali
Materials Science and Nanotechnology
116R

Progetto di ricerca Research project	ENG: <i>New Sustainable Approaches to vulcanization in rubber composite (PROG.2)</i>
Tipo/Type	Borse finanziate da enti esterni / Scholarships funded by external organizations
Finanziatore Funding Body	Consorzio CORIMAV-PIRELLI TYRE
Borse/Scholarships	1
Abstract	ENG: Vulcanization refers to a set of chemical processes that transform elastomeric polymers from their natural state into a material exhibiting enhanced elastic properties and improved resistance to deformation. In rubber based composites, vulcanization is generally associated with the reaction of poly-diene polymers—characterized by unsaturation along the polymer backbone—with sulfur. This process is facilitated by specific chemical additives, commonly referred to as activators and accelerators, which improve reaction efficiency in terms of both kinetics and the distribution of intermolecular crosslinks. In tire manufacturing, the vulcanization process plays a critical role in defining the performance of the final product, directly influencing rolling resistance, road handling, wear behavior, and, consequently, the environmental impact during service life. Within this framework, the PhD research project aims to identify and develop alternative vulcanization strategies that enhance material performance while ensuring industrial feasibility. Sustainability considerations are central to the research, encompassing the use of more sustainable materials and chemistries, improved process efficiency, reduced environmental footprint during manufacturing and service life, and a contribution to the development of more durable rubber-based products. Starting from literature analysis, the research will involve organic synthesis for the development of new materials, that will be subjected to comprehensive chemical, physical, and mechanical characterization to establish structure–property relationships and benchmark their performance against conventional systems in rubber compounds. The activity will involve strong interaction with the industrial laboratories.
Tutor	Prof. Mauro Sassi (Supervisor) Prof. Luca Beverina (Tutor) Pirelli Tutor: Dr Luigia Rossiello
Abroad period	6 months
Specific rules	Intellectual property clauses agreed with the Company apply to this scholarship

Scienza e Nanotecnologia dei Materiali
Materials Science and Nanotechnology
116R

Progetto di ricerca Research project	ENG: <i>Multiscale Morphological Investigation of Elastomeric Nanocomposites: Correlating 3D Interfacial Architecture with Macroscopic Tyre Performance (PROG.3)</i>
Tipo/Type	Borse finanziate da enti esterni / Scholarships funded by external organizations
Finanziatore Funding Body	Consorzio CORIMAV-PIRELLI TYRE
Borse/Scholarships	1
Abstract	ENG: The performance and durability of tyre materials are strongly influenced by the microstructural architecture of rubber compounds and by the behaviour of interfaces involving polymers, fillers, metallic reinforcements and textile components. Understanding the morphological and compositional gradients that arise at these interfaces is essential to explain phenomena such as adhesion, debonding, chemical–mechanical degradation and the evolution of the material during operational life. Within this framework, the PhD project aims to investigate in depth the microstructure of tyre compounds through advanced electron microscopy techniques in order to characterize critical interfaces, identify phases, map filler distribution and correlate microstructural features with mechanical and chemical degradation mechanisms. The research activity will include the development of preparation, ageing and modification protocols for the samples for reproducing operative conditions and to study the evolution of interfacial phenomena under realistic constraints. Whenever microscopic techniques alone do not yield a complete understanding, complementary analytical techniques—such as spectroscopic, thermal, dynamic-mechanical and AFM-based methods—will be integrated to build a complete multiscale understanding of the materials. The expected outcome is a significant advancement in the fundamental knowledge of interfacial behaviour in tyre materials, supporting the design of reliable, durable and high-performance products with enhanced sustainability. The PhD student will work in close collaboration with industrial laboratories throughout the project.
Tutor	Prof. Giancarlo Capitani (Supervisor) Prof. Barbara Di Credico (Supervisor and Tutor) Pirelli Tutor: Marco Arimondi, Davide Turco
Abroad period	6 months
Specific rules	Intellectual property clauses agreed with the Company apply to this scholarship

Scienze Chimiche, Geologiche e Ambientali

Chemical, Geological and Environmental Sciences

124R

Curr. Scienze Chimiche - Chemical Sciences

Progetto di ricerca Research project	<p>ITA: <i>Modellizzazione dell'attivazione vibrazionale su catalizzatori ad atomo singolo con simulazioni di chimica quantistica combinate con machine learning (PROG.1)</i></p> <p>ENG: <i>Modelling vibrational activation on Single-Atom Catalysts with machine learning accelerated quantum chemical simulations (PROG.1)</i></p>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	<p>ITA: Questo progetto si concentrerà sulla modellazione dell'attivazione catalitica di molecole stabili su catalizzatori ad atomo singolo, una delle frontiere più innovative della ricerca in catalisi. Questo progetto teorico sfrutterà approcci di chimica quantistica all'avanguardia, combinati con metodi machine learning. L'obiettivo del progetto sarà identificare i principali descrittori catalitici per l'attivazione molecolare, incluso il ruolo dell'eccitazione vibrazionale, un aspetto importante nella catalisi al plasma.</p> <p>ENG: This project will be focused on the modelling of catalytic activation of stable molecules on single-atom catalysts, one the hot frontier of catalysis research. This theoretical project will take advantage of cutting-edge quantum chemical approaches combined with machine learning accelerated tools. The scope of the project will be to identify key catalytic descriptors for molecular activation including the role of vibrational excitation, an important aspect in plasma catalysis.</p>
Tutor	Prof. Claudio Greco (supervisor: Dr. Giovanni Di Liberto)
Abroad period	to be defined
Specific rules	to be defined

Scienze Chimiche, Geologiche e Ambientali
Chemical, Geological and Environmental Sciences - 124R
Curr. Scienze Geologiche - Geological Sciences

Progetto di ricerca Research project	<p>ITA: <i>Compressione dinamica di materiali ricchi in zolfo per indagare il ruolo degli impatti planetari e meteoritici nell'evoluzione primordiale della Terra (PROG.2)</i></p> <p>ENG: <i>Shock-driven dynamic compression of sulphur-bearing materials to investigate the role of planetary and meteoritic impacts on early Earth evolution (PROG.2)</i></p>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	<p>ITA: L'accrezione planetaria e gli impatti meteoritici hanno svolto un ruolo fondamentale nel modellare l'evoluzione primordiale della Terra. Tuttavia, il comportamento e le proprietà fisico-chimiche dei minerali e materiali contenenti zolfo sollecitati a compressione da shock, rimangono ancora poco studiati. Questo progetto mira a investigare le trasformazioni di fase, le relazioni di fusione ("melting") e le reazioni chimiche dei principali composti contenenti zolfo in condizioni di compressione dinamica rilevanti per le collisioni planetarie, nell'ambito delle geoscienze e delle scienze planetarie in condizioni di pressioni e temperatura estreme. La ricerca impiegherà esperimenti di shock indotto da laser ad alta energia presso grandi infrastrutture internazionali (ad esempio EuXFEL, ESRF, LULI), combinati con diffrazione e spettroscopia a raggi X in situ e risolte nel tempo e con analisi microstrutturali post-mortem. La preparazione dei campioni e le analisi post-mortem (che includono l'uso di FIB/SEM, TEM e spettroscopia Raman) saranno svolte presso l'istituzione ospitante. Le attività prevedono circa il 50% di lavoro sperimentale/di laboratorio, il 30% di analisi dati e modellizzazione e il 20% di scrittura di proposte e articoli scientifici. Il dottorato include un periodo obbligatorio di ricerca all'estero di 12 mesi presso infrastrutture e istituzioni partner di primo livello (ad es. EuXFEL, ESRF). La posizione è vincolata al progetto ERC Consolidator Grant S-CAPE ed è supportata da fondi dedicati che coprono campagne sperimentali, trasferte e costi analitici oltre alle dotazioni standard previste per i dottorandi.</p> <p>ENG: Planetary accretion and meteoritic impacts played a fundamental role in shaping Earth's early evolution, yet the behaviour of sulphur-bearing materials under shock compression remains poorly constrained. This project aims to investigate phase transformations, melting relations, and chemical reactions of key sulphur-bearing compounds under dynamic compression relevant to planetary collisions, within the field of extreme-conditions geo- and planetary science. The research will employ laser-driven shock experiments at large-scale facilities (e.g., EuXFEL, ESRF, LULI), combined with time-resolved in situ X-ray diffraction and spectroscopy and post-mortem microstructural analyses. Samples preparation and post-mortem analyses (which include the use of FIB/SEM, TEM and Raman spectroscopy) will be carried out at the home institution. Activities will involve ~50% laboratory/experimental work and ~30% data analysis/modelling and ~20% proposals and manuscripts writing. The PhD includes a mandatory research period abroad of 12 months at leading international facilities and partner institutions (e.g., EuXFEL, ESRF). The position is project-bound within the ERC Consolidator Grant S-CAPE and is supported by dedicated project funding covering experimental campaigns, travel, and analytical costs beyond standard PhD allocations.</p>
Tutor	supervisor: Prof. Cerantola Valerio
Abroad period	12 months
Specific rules	no specific rules

Scienze Chimiche, Geologiche e Ambientali Chemical, Geological and Environmental Sciences 124R Curr. Scienze Ambientali - Environmental Sciences	
Progetto di ricerca Research project	<p>ITA: <i>Relazioni tra inquinamento da plastica, plastisfera, ciclo del carbonio e metabolismo acquatico negli ecosistemi lacustri (PROG.3)</i></p> <p>ENG: <i>Linking plastic pollution and the plastisphere to carbon cycling and aquatic metabolism in lake ecosystems (PROG.3)</i></p>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	<p>ITA: Le attività antropiche e il cambiamento climatico stanno modificando i flussi di carbonio nei laghi, rafforzandone spesso il ruolo come sorgenti di carbonio. Tuttavia, le plastiche, pur essendo composte da carbonio e diffuse a livello globale, rimangono assenti dai modelli del ciclo del carbonio lacustre. Questo progetto di dottorato indagherà come le plastiche alterino i processi di trasformazione del carbonio lungo un gradiente di diverse tipologie di laghi (urbani ed alpini). Verranno valutati il rilascio e la reattività del carbonio organico derivato dalle plastiche e i loro effetti sull'attività microbica, sulla biodiversità e sui percorsi di trasformazione del carbonio. Il progetto esaminerà inoltre il ruolo delle plastiche come substrati per la colonizzazione microbica e algale, valutandone le conseguenze sulla struttura della rete trofica, sul metabolismo lacustre e sulla produzione netta dell'ecosistema. La borsa di dottorato è finanziata dal progetto 'PANIC: Plastics as Novel Interference in the Carbon Cycle', sostenuto dal Fondo Italiano della Scienza (FIS3).</p> <p>ENG: Human activities and climate change are reshaping carbon fluxes in lakes, often strengthening their role as carbon sources. Yet plastics, despite being carbon-based and globally pervasive, remain absent from lake carbon cycling frameworks. This Ph.D. project will investigate how plastics alter carbon processing across a gradient of lake types (urban and alpine). It will assess the release and reactivity of plastic-derived organic carbon and their effects on microbial activity, biodiversity, and carbon transformation pathways. The project will also examine plastics as substrates for microbial and algal colonization, evaluating consequences for food web structure, lake metabolism, and net ecosystem production. The fellowship is funded by the project 'PANIC: Plastics as Novel Interference in the Carbon Cycle', supported by the Fondo Italiano della Scienza (FIS3).</p>
Tutor	Prof. Barbara Leoni (supervisor: Dr. Veronica Nava)
Abroad period	to be defined
Specific rules	to be defined

Scienze Chimiche, Geologiche e Ambientali
Chemical, Geological and Environmental Sciences

124R

Curr. Scienze Ambientali - Environmental Sciences

Progetto di ricerca Research project	<p>ITA: <i>Sviluppo di algoritmi avanzati e metodologie di validazione per la stima della fluorescenza indotta dal sole nella ambito della missione FLEX (PROG.4)</i></p> <p>ENG: <i>Advancing Solar-Induced Fluorescence Retrieval: Development of Innovative Algorithms and Validation Frameworks for the FLEX Mission (PROG.4)</i></p>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	<p>ITA: Le attività di ricerca si inseriscono nell'ambito della missione FLuorescence EXplorer (FLEX), sviluppata dall'Agenzia Spaziale Europea (ESA) nell'ambito del programma Earth Explorer. FLEX è concepita per acquisire misure spazialmente continue su scala globale della Fluorescenza Indotta dal Sole (Solar-Induced Fluorescence, SIF), il segnale ottico più direttamente correlato all'attività fotosintetica e allo stato fisiologico della vegetazione terrestre. SIF costituisce una variabile diagnostica fondamentale per la comprensione quantitativa dell'assimilazione del carbonio da parte degli ecosistemi terrestri e per potenziare le capacità di monitoraggio relativamente alla produttività agricola e alla sicurezza alimentare. Sebbene FLEX non misuri direttamente la fotosintesi, il suo innovativo strumento fornirà informazioni fondamentali necessarie per inferire l'attività fotosintetica da piattaforme satellitari, contribuendo così ad affrontare rilevanti sfide scientifiche. Selezionata nel 2015 come ottava missione Earth Explorer, FLEX opererà in configurazione tandem con il satellite Copernicus Sentinel-3, sfruttando le sinergie con gli strumenti OLCI e SLSTR. Il lancio è previsto tra settembre e novembre 2026, con una vita operativa nominale di tre anni e mezzo. In questo contesto, le attività di ricerca pianificate perseguono due obiettivi scientifici strettamente interconnessi. Il primo riguarda lo sviluppo e il perfezionamento di algoritmi per il retrieval della SIF da osservazioni satellitari. Una volta disponibili le misure operative di FLEX, lo schema di retrieval dovrà essere ulteriormente adattato alle caratteristiche radiometriche, spettrali e geometriche dei dati satellitari. Tali sviluppi comprenderanno inoltre la modellizzazione dell'anisotropia della riflettanza bidirezionale a livello di canopy, nonché l'estensione dell'algoritmo di retrieval a strumenti da terra e aerei. L'obiettivo generale è fornire un retrieval dello spettro di SIF migliorato e fisicamente consistente, che possa essere sfruttato in modo più efficace per l'interpretazione dei processi fisiologici alla scala di canopy. Il secondo obiettivo riguarda la definizione di protocolli di validazione per i prodotti dati di Livello 2 della missione. Ciò comprende lo sviluppo di metodologie di validazione robuste e metrologicamente tracciabili, fondate su misure di riferimento indipendenti acquisite da terra e da piattaforme aeree, progettate per garantire l'accuratezza, la consistenza interna e la tracciabilità dei prodotti geofisici derivati da FLEX su un insieme rappresentativo di tipologie vegetazionali e condizioni atmosferiche.</p> <p>ENG: The research activities are framed within the FLuorescence EXplorer (FLEX) mission, developed by the European Space Agency (ESA) as part of the Earth Explorer program. FLEX is conceived to acquire spatially continuous, global-scale measurements of Solar-Induced Fluorescence (SIF), the optical signal most directly coupled to the activity of the photosynthetic apparatus and to the physiological state of terrestrial vegetation, encompassing stress-related responses. SIF constitutes a key diagnostic variable for advancing the quantitative understanding of terrestrial carbon assimilation and for enhancing Earth observation-based monitoring capabilities in relation to agricultural productivity and food security. Although FLEX does not retrieve photosynthesis directly, its</p>

	<p>innovative imaging spectrometer will deliver the fundamental spectral observables required to infer photosynthetic activity from space-borne platforms, thereby addressing critical scientific and societal challenges. Selected in 2015 as the eighth Earth Explorer mission, FLEX will operate in a tandem configuration with the Copernicus Sentinel-3 satellite, exploiting radiometric and temporal synergies with the OLCI and SLSTR instruments. Launch is scheduled for September–November 2026, with a nominal operational lifetime of three and a half years. Within this framework, the planned research activities pursue two closely interconnected scientific objectives. The first pertains to the development and systematic refinement of algorithms for the retrieval of SIF from spaceborne observations. Once operational measurements from FLEX become available, the retrieval scheme will require further adaptation to the radiometric, spectral, and geometric characteristics of the satellite data. These developments will additionally encompass the explicit modelling of canopy-level bidirectional reflectance anisotropy, as well as the extension of the retrieval framework to ground-based and airborne instruments. The overarching aim is to deliver an improved and physically consistent SIF spectrum retrieval that can be more effectively exploited for the interpretation of canopy-scale physiological processes. The second objective concerns the systematic definition of validation protocols for the mission Level-2 data products. This encompasses the development of robust, metrologically traceable validation methodologies founded on independent ground-truth and airborne reference measurements, designed to ensure the accuracy, internal consistency, and traceability of the FLEX-derived geophysical products across a representative range of vegetation types and atmospheric conditions.</p>
Tutor	Prof. Micol Rossini (supervisor: Prof. Sergio Cogliati)
Abroad period	to be defined
Specific rules	no specific rules

Scienze Chimiche, Geologiche e Ambientali
Chemical, Geological and Environmental Sciences
124R
Curr. Scienze Ambientali - Environmental Sciences

Progetto di ricerca Research project	ENG: <i>Development of algorithms and cal/val tool for retrieval of phytoplankton fluorescence in aquatic ecosystems in the context of the FLEX mission (PROG.5)</i>
Tipo /Type	Borse finanziate da enti esterni / Scholarships funded by external organizations
Finanziatore Funding Body	Consiglio Nazionale delle Ricerche – Istituto per il Rilevamento Elettromagnetico dell’Ambiente “CNR-IREA”
Borse/Scholarships	1
Abstract	<p>ENG: The research activities are part of the Fluorescence Explorer (FLEX) mission, promoted by the European Space Agency (ESA) to generate global maps of Sun induced fluorescence of terrestrial vegetation that can reflect photosynthetic activity and plant health and stress. FLEX was selected as the eighth Earth Explorer mission within ESA's Living Planet Programme in 2015 and will operate in tandem with the Copernicus Sentinel-3 mission, in combination with the OLCI and SLSTR instruments. The launch is expected in 2026, with a three-and-a-half-year design lifetime. Although FLEX has been specifically designed for applications over terrestrial vegetation, its hyperspectral capability can potentially be very beneficial also in open waters, coastal areas and inland waters. In particular, the Sun-induced fluorescence (SIF) emission from chlorophyll-a (Chl-a) pigments in phytoplankton has been widely used as a proxy for estimating Chl-a concentration in oceans, and can provide insights to trophic status, algal bloom development, and phytoplankton physiology. Improved knowledge of phytoplankton dynamics is essential for understanding biogeochemical cycles, water quality, and ecosystem functioning and stress conditions in inland and coastal waters. Furthermore, the hyperspectral range of the FLEX sensor also enables the retrieval of accessory pigments of phytoplankton, such as phycocyanin and phycoerythrin. Overall, being in tandem with OLCI, FLEX can support a wide range of applications for aquatic ecosystems. The overall aim of the study is hence to assess the performance of FLEX in aquatic ecosystems studies. To the aim the first objective of the planned activities involves defining appropriate validation procedures for the mission's fluorescence products in aquatic environments, while the second focus concerns the development and refinement of algorithms for estimating fluorescence signals over water bodies, integrating satellite observations with airborne hyperspectral measurements and in situ data. The validation component will rely on indirect approaches based on radiative transfer simulations adapted to optically complex waters. In this framework, fluorescence signals will be simulated for selected study sites using optical models parameterized with high-resolution information on water constituents, such as Chl-a concentration. This strategy could enable the exploitation of well-characterized aquatic sites where continuous fluorescence measurements may not be available. The improved retrieval algorithms will account for water-specific effects such as surface reflectance contributions, adjacency effects from surrounding land, and the influence of varying optical properties on the fluorescence signal. Particular attention will be given to enhancing the retrieval of SIF in phytoplankton communities, in order to support a more comprehensive analysis of phytoplankton community dynamics and contribute to improved monitoring of aquatic ecosystems from space.</p>
Tutor	Tutor Unimib: Prof. Cogliati Sergio; Supervisor CNR – IREA: Dr. Claudia Giardino, Dr. Mariano Bresciani
Abroad period	to be defined
Specific rules	no specific rules

Scienze Marine, Tecnologie e Gestione

Marine Sciences, Technology and Management

128R

Progetto di ricerca Research project	<p>ITA: <i>Monitoraggio scalabile degli ecosistemi costieri tramite droni in contesti di cambiamento ambientale</i></p> <p>ENG: <i>Scalable Drone-Based Monitoring of Coastal Ecosystems under Environmental Change</i></p>
Tipo/Type	Borse di Ateneo riservati a stranieri / University Scholarships reserved for foreign students
Borse/Scholarships	1
Abstract	<p>ITA: Gli ecosistemi costieri stanno subendo un rapido degrado a causa dei cambiamenti climatici e della crescente pressione antropica. La conservazione e il ripristino efficace di questi ambienti richiedono approcci di monitoraggio in grado di catturare sia le condizioni dell'habitat sia le risposte ecologiche a scale spaziali e temporali appropriate. Questo progetto mira a contribuire allo sviluppo di protocolli di monitoraggio ecologico standardizzati e trasferibili per gli habitat costieri e la fauna associata, con particolare attenzione all'utilizzo di veicoli aerei senza pilota (UAV). La ricerca indagherà come i rilevamenti basati su droni possano essere integrati con tecniche di monitoraggio consolidate per migliorare la valutazione della struttura degli habitat, della variabilità ambientale e della distribuzione e del comportamento della fauna. Particolare attenzione sarà dedicata ai limiti di rilevabilità, alla risoluzione spaziale, alla ripetibilità e all'integrazione con approcci di monitoraggio complementari, con l'obiettivo di individuare buone pratiche per il monitoraggio ecologico a lungo termine degli ecosistemi costieri.</p> <p>ENG: Coastal ecosystems are experiencing rapid degradation due to climate change and increasing human pressure. Effective conservation and restoration of near-shore environments requires monitoring approaches capable of capturing both habitat conditions and ecological responses at appropriate spatial and temporal scales. This project aims to contribute to the development of standardized and transferable ecological monitoring protocols for coastal habitats and associated fauna, with a particular focus on the use of unmanned aerial vehicles (UAVs). The research will investigate how drone-based surveys can be integrated with established monitoring techniques to improve the assessment of habitat structure, environmental variability, and faunal distribution and behavior. Particular attention will be given to detection limits, spatial resolution, repeatability, and integration with complementary monitoring approaches, with the aim of identifying best practices for long-term coastal ecological monitoring.</p>
Tutor	Prof. Paolo Galli
Abroad period	6 months
Specific rules	no specific rules

Scienze Marine, Tecnologie e Gestione
Marine Sciences, Technology and Management
128R

Progetto di ricerca Research project	ENG: <i>Design of Biodegradable Smart Multimaterial Systems for Marine Ecosystem Restoration (PROG.1)</i>
Tipo/Type	Borse finanziate da enti convenzionati / Scholarships funded by partner organizations
Finanziatore Funding Body	Istituto Italiano Tecnologia
Borse/Scholarships	1
Abstract	ENG: Engineering of multifunctional composite systems based on biodegradable biopolymers, bioactive molecules, and functional fillers for targeted marine ecosystem restoration. Emphasis is placed on tunable physicochemical properties, controlled degradation kinetics, interfacial interactions, and bioactivity to promote underwater habitat regeneration, biofouling control, and ecosystem resilience.
Tutor	to be defined
Abroad period	to be defined
Specific rules	no specific rules

Scienze Marine, Tecnologie e Gestione
Marine Sciences, Technology and Management
128R

Progetto di ricerca Research project	ENG: <i>Marine-Derived Smart Biomaterials for Biointerfaces and Controlled Release Platforms (PROG.2)</i>
Tipo / Type	Borse finanziate da enti convenzionati / Scholarships funded by partner organizations
Finanziatore Funding Body	Istituto Italiano Tecnologia
Borse/Scholarships	1
Abstract	ENG: Development of advanced biodegradable biomaterials sourced from marine feedstocks (e.g., polysaccharides, proteins, and marine-derived polymers) for engineered biointerfaces and stimuli-responsive controlled release systems. Applications include smart packaging, precision agriculture, and sustainable food and water technologies, with a focus on material–environment interactions, release kinetics modulation, barrier performance, and environmental compatibility.
Tutor	to be defined
Abroad period	to be defined
Specific rules	no specific rules

Strategic Innovation for Sustainable and Smart Ecosystems
134R

Progetto di ricerca Research project	ENG: <i>Geo-engineered Carbon Cycles: Mineralization and Brine Valorisation in the Circular Economy (PROG.1)</i>
Tipo/Type	Borse di Ateneo / University Scholarships
Borse/ cholarships	1
Abstract	<p>ENG: This PhD project addresses the integration of geochemical, mineralogical, and technological processes for CO₂ fixation and valorisation using mineral and saline waste streams, within a circular economy framework. The research focuses on the development of sustainable geo-engineering strategies aimed at accelerating natural carbonation reactions while recovering strategic raw materials such as magnesium, calcium, and silica from mining residues and desalination brines. The project will be developed in collaboration with the University of Palermo, the Polytechnic University of Catalonia (UPC), the Swiss company Gr3n Recycling SA, the Italian utility company A2A, and the Italian spin-off Resourceas Srl. It combines experimental geochemistry, mineralogical characterisation, and process engineering, exploiting microwave-assisted carbonation and electrochemical membrane technologies (bipolar membrane electrodialysis) to enhance mineral reactivity and enable circular acid–base regeneration. The main objective is to investigate, model, and optimise mineral transformation mechanisms underlying a novel anthropogenic carbon cycle, in which natural geological processes are mimicked and intensified under controlled conditions. The project will integrate laboratory-scale experiments, geochemical modelling, and environmental impact assessment to quantify carbon sequestration efficiency, material recovery potential, and sustainability performance. Aligned with the mission of the SIS2E program, the PhD candidate will be trained as an interdisciplinary researcher bridging Earth Sciences, Industry, and Society, capable of supporting sustainable innovation pathways and effectively communicating scientific results to academic, industrial, and institutional stakeholders.</p>
Tutor	Prof. Davide Alberti, Prof. Nadia Malaspina
Abroad period	6 months at Gr3n; 12 months at UPC
Specific rules	no specific rules

Strategic Innovation for Sustainable and Smart Ecosystems

134R

Progetto di ricerca Research project	ENG: <i>School–University Collaboration for Social Sustainability: Models and Tools for Teachers’ and School Leaders’ Professional Development (PROG.2)</i>
Tipo / Type	Borse di Ateneo / University Scholarships
Borse/Scholarships	1
Abstract	<p>ENG: Educational institutions, viewed from a systemic-relational and ecological perspective, can be understood as complex, dynamic, and adaptive ecosystems—authentic “learning hubs” grounded in the relationships among students, teachers, school staff, stakeholders, and local communities. Recent literature emphasises how school governance and the professional development of teachers and school leaders significantly influence the quality of educational provision. In the Italian context in particular, school autonomy represents a strategic lever for responding creatively and flexibly to the needs of local territories and diverse student populations. However, realising this potential requires strengthening schools’ organisational and pedagogical capacities. Moving beyond traditional transmissive, self-referential, and content-centred models, schools are increasingly called to foster relational capital, attentive listening, and the recognition of evolving subjectivities, counteracting anonymity and loss of agency. In line with the OECD “learning hub” framework (2020; 2024), innovation emerges through active participation in governance and school life, interdisciplinary dialogue, and collaboration across educational contexts. Practices such as co-design, communities of practice, mentoring, and service learning become key drivers of professional growth and institutional development. Within this framework, school–university collaboration can function as a strategic ecosystem for social sustainability, supporting reflective practice, shared research, and the co-construction of partnership models and operational tools. The project aims to develop and test models that enhance professional learning, strengthen participatory governance, and promote inclusive and context-responsive educational environments. Ultimately, it seeks to contribute to citizenship development and well-being, prevent early school leaving and educational disadvantage, and expand equitable access to meaningful learning opportunities.</p> <p>Expected profile:</p> <ul style="list-style-type: none"> - Experience in training and research activities related to school governance, educational innovation, and communities of practice - Participation in collaborative projects with schools - Competence in qualitative research methods (interviews, focus groups, case studies)
Tutor	Prof. Giulia Pastori, Prof. Luisa Zecca.
Abroad period	3 months
Specific rules	no specific rules

Strategic Innovation for Sustainable and Smart Ecosystems

134R

Progetto di ricerca Research project	ITA: <i>Biotechnologie innovative per la salute, l'ambiente e i materiali avanzati (PROG.3)</i> ENG: <i>Innovative Biotechnologies for Health, the Environment, and Advanced Materials (PROG.3)</i>
Borse/Scholarships	nr 1 Borsa di Ateneo / nr 1 University Scholarship
Abstract	<p>ITA: Le biotecnologie innovative rappresentano oggi un ambito strategico per affrontare in modo integrato le sfide della salute umana, della sostenibilità ambientale e dello sviluppo di materiali funzionali avanzati. L'integrazione tra biologia molecolare, microbiologia, chimica verde e scienza dei materiali consente di progettare soluzioni ad alto impatto tecnologico, riducendo al contempo l'impronta ecologica dei processi produttivi. Dalla medicina di precisione alla biodegradazione delle plastiche, fino alla produzione microbica di molecole ad alto valore aggiunto e allo sviluppo di biomateriali fotoattivi, le biotecnologie offrono strumenti concreti per una transizione verso sistemi più resilienti e bio-based con elevate potenzialità di innovazione, trasferimento tecnologico e scalabilità industriale. In questo contesto, il progetto di dottorato può articolarsi in una delle seguenti linee di ricerca:</p> <ul style="list-style-type: none"> • Sviluppo di ingredienti nutraceutici sostenibili mediante Natural Deep Eutectic Solvents (NaDES) • Sviluppo di strategie microbiche per la biodegradazione di polimeri plastici sintetici • Next generation diagnostics: sviluppo e trasferimento di metodologie molecolari nella medicina di precisione • Light-sensitive organic materials for organelle-specific control of intracellular signaling • Microbial cell factories for production of carotenoids and other organic molecules for the development of edible electronics. <p>ENG: Innovative biotechnologies today represent a strategic field for addressing, in an integrated manner, the challenges of human health, environmental sustainability, and the development of advanced functional materials. The integration of molecular biology, microbiology, green chemistry, and materials science enables the design of high-technological-impact solutions while simultaneously reducing the ecological footprint of production processes. From precision medicine to plastic biodegradation, and from the microbial production of high value-added molecules to the development of photoactive biomaterials, biotechnologies provide concrete tools for a transition toward more resilient and bio-based systems with strong potential for innovation, technology transfer, and industrial scalability. In this context, the PhD project may be developed within one of the following research lines:</p> <ul style="list-style-type: none"> • Development of sustainable nutraceutical ingredients using Natural Deep Eutectic Solvents (NaDES) • Development of microbial strategies for the biodegradation of synthetic plastic polymers • Next generation diagnostics: development and translation of molecular methodologies into precision medicine • Light-sensitive organic materials for organelle-specific control of intracellular signaling • Microbial cell factories for the production of carotenoids and other organic molecules for the development of edible electronics.
Tutor	to be defined
Abroad period	6 months
Specific rules	no specific rules

Strategic Innovation for Sustainable and Smart Ecosystems
134R

Progetto di ricerca Research project	ITA: <i>Sviluppo di diagnostiche per "Burning Plasmas" (PROG.4)</i> ENG: <i>Development of Burning Plasmas Diagnostics (PROG.4)</i>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	<p>ITA: La ricerca sulla fusione nucleare mediante confinamento magnetico sta entrando nell'era dei plasmi che bruciano, ossia uno stato della materia in cui, per la prima volta, si otterrà un guadagno netto dalle reazioni di fusione. A tal fine, vi è una crescente esigenza di sviluppare tecniche diagnostiche in grado di fornire informazioni sullo stato del plasma attraverso la rivelazione e lo studio della radiazione emessa prevalentemente nella regione centrale dei plasmi che bruciano. Questo progetto di ricerca mira allo sviluppo di strumenti e/o metodi sperimentali per lo studio di plasmi rilevanti per i reattori. È previsto un periodo minimo di 4 mesi all'estero (estendibile fino a 6 mesi a seconda del progetto), dedicato prevalentemente alla partecipazione a esperimenti, attività di modellizzazione o di progettazione presso dispositivi tokamak. Il/la candidato/a ideale possiede una laurea magistrale in fisica o ingegneria e ha già qualche conoscenza nel campo della fusione nucleare o in discipline affini. È inoltre interessato/a a diventare un protagonista attivo della nascente era della fusione nucleare, combinando conoscenze di fisica e tecnologia della fusione in vista dello sviluppo di centrali elettriche a fusione su scala industriale.</p> <p>ENG: Nuclear fusion research by magnetic confinement is entering the era of burning plasmas, i.e. a state of matter where net gain by the fusion reactions will be obtained for the first time. To this end, there is an increasing demand to develop diagnostic techniques that can provide information on the plasma state by the detection and study of the radiation emitted predominantly by the core of plasmas that approach the burning state. This research project aims at developing instruments and/or experimental methods to study reactor relevant plasmas. A minimum period of 3 months abroad (extendable to 6 months depending on the project) predominantly dedicated to participation in experiments, modelling or design activities at tokamak devices is foreseen. The ideal applicant holds a master's degree in physics or engineering and has some background in nuclear fusion or related subjects. They are also interested in becoming an active player of the emerging nuclear fusion era by combining knowledge on aspects of both fusion physics and technology towards the development of industrial scale fusion power plants.</p>
Tutor	Prof. Giuseppe Gorini, Prof. Gabriele Croci
Abroad period	4 months
Specific rules	no specific rules

Strategic Innovation for Sustainable and Smart Ecosystems

134R

Progetto di ricerca Research project	<p>ITA: <i>Sviluppo e applicazione di un'infrastruttura multisensore per lo studio del comportamento (PROG.5)</i></p> <p>ENG: <i>Development and application of a multisensor infrastructure for the study of behavior (PROG.5)</i></p>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	<p>ITA: Il progetto di dottorato industriale sarà finalizzato al testing e alla validazione di un ecosistema integrato di sensori digitali per la ricerca psicologica, sviluppato nell'ambito del laboratorio BiHOME del Dipartimento di Psicologia dell'Università di Milano-Bicocca (Progetti dei Dipartimenti di Eccellenza 2023–2027). In particolare, l'attività riguarderà l'impiego di sensori fisiologici (es. EmotiBit e Polar Band) in integrazione con la sensoristica ambientale già prevista nell'infrastruttura BiHOME. Il/la dottorando/a individuerà un caso d'uso applicativo in ambito psicologico, progettando protocolli di acquisizione e analisi dei dati comportamentali e fisiologici raccolti dall'ecosistema. Il percorso includerà anche l'integrazione di ulteriori sensori digitali, in funzione delle esigenze del caso d'uso selezionato. Una parte centrale del progetto sarà dedicata allo sviluppo di macro, script e pipeline per il preprocessing, il data crunching e l'estrazione di indicatori utili dalla piattaforma di registrazione dati BiHOME. La linea di ricerca si caratterizza per un'impostazione aperta e interdisciplinare, orientata sia alla sperimentazione metodologica sia alla trasferibilità applicativa.</p> <p>ENG: The industrial PhD project will focus on the testing and validation of an integrated ecosystem of digital sensors for psychological research, developed within the BiHOME laboratory at the Department of Psychology, University of Milano-Bicocca (Departments of Excellence Projects 2023–2027). In particular, the work will involve the use of physiological sensors (e.g., EmotiBit and Polar Band) in combination with the environmental sensing infrastructure already planned within BiHOME. The PhD candidate will identify a relevant use case in the field of psychology and design protocols for the acquisition and analysis of behavioral and physiological data collected through the sensor ecosystem. The project will also include the integration of additional digital sensors, depending on the requirements of the selected use case. A central component of the work will be the development of macros, scripts, and data-processing pipelines for preprocessing, data crunching, and the extraction of meaningful indicators from the BiHOME data-recording platform. Overall, the research line is conceived as open and interdisciplinary, with a dual focus on methodological experimentation and applied transferability.</p>
Tutor	to be defined
Abroad period	4 months
Specific rules	no specific rules

Strategic Innovation for Sustainable and Smart Ecosystems
134R

Progetto di ricerca Research project	ENG: <i>Artificial Intelligence and the transformation of risk assessment: a legal analysis (PROG.6)</i>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	ENG: The project investigates how AI-driven tools are transforming corporate risk assessment and compliance systems. It focuses on the regulatory implications of the AI Act, particularly its risk-based approach and requirements for risk management, accountability, transparency, and human oversight. The study also examines the interaction between AI-based risk assessment and organizational models under Legislative Decree 231/2001, which establishes corporate liability and mandates preventive compliance programs. The project aims to identify the conditions for the responsible integration of AI into corporate compliance frameworks, ensuring that technological innovation aligns with accountability and fundamental legal safeguards.
Tutor	Prof. Alberto Villa
Abroad period	4 months
Specific rules	no specific rules

Strategic Innovation for Sustainable and Smart Ecosystems

134R

Progetto di ricerca Research project	<p>ITA: <i>Misura e rappresentazione del “protagonismo umano”, come fattore chiave dei progetti di sviluppo socio-economico. (PROG.7)</i></p> <p>ENG: <i>Measurement and Representation of “Human Protagonism” as a Key Factor in Socio-Economic Development Projects (PROG.7)</i></p>
Tipo/Type	Borse finanziate da aziende convenzionate / Scholarships funded by partner companies
Finanziatore Funding Body	Fondazione AVSI - ETS
Borse/Scholarships	1
Abstract	<p>ITA: Introduzione. La riflessione contemporanea sulla valutazione nei progetti di sviluppo è sempre più caratterizzata dal ricorso a indicatori di natura economica e operativa. Questa impostazione privilegia la misurabilità e la comparabilità dei risultati, che nella prassi dello sviluppo vengono utilizzati non solo come strumenti di indagine, ma anche come criteri di confronto tra interventi differenti e come dispositivi di rendicontazione verso i soggetti finanziatori. Privilegiando questa dimensione di comparabilità, l’apparato di misura standard dei progetti di sviluppo si concentra su dimensioni esteriori ai soggetti coinvolti nei progetti di sviluppo. In tal modo, si trascura la valutazione dell’impatto alle dimensioni interne al soggetto umano, come la capacità di riconoscersi e di agire come soggetto attivo e responsabile del proprio percorso individuale e collettivo; e ciò, nonostante sia questo l’outcome determinante per la sostenibilità degli interventi stessi. In assenza di strumenti di misura adeguati, questo fattore chiave dello sviluppo, che qui chiamiamo protagonismo, rimane confinato a un livello marginale o puramente descrittivo, affidato all’osservazione qualitativa o al giudizio professionale degli operatori, senza diventare parte strutturale dei processi di progettazione, implementazione e valutazione degli interventi di sviluppo.</p> <p>Obiettivi del progetto. Il progetto si colloca all’intersezione tra sviluppo umano, psicometria e statistica e ha i seguenti obiettivi:</p> <ol style="list-style-type: none"> 1. Concettualizzare e definire il costrutto “protagonismo umano”, individuandone dimensioni e driver e disegnandone un modello di misura. 2. Costruire scale di misura delle dimensioni del protagonismo umano. 3. Sviluppare sistemi di sintesi degli indicatori per singolo pilastro e per il costrutto generale, utilizzando sia i metodi classici basati su modelli a variabili latenti riflessivi o formativi e su indicatori compositi, che le più recenti metodologie di sintesi non-aggregativa apparse nella letteratura statistica degli ultimi anni, con particolare riferimento agli algoritmi basati sulla teoria degli ordinamenti parziali. Il sistema di sintesi dovrà comprendere sia lo sviluppo di indicatori unidimensionali, che il disegno di rappresentazioni multi-dimensionali, per complementare misure di intensità con strumenti di descrizione/analisi dei pattern. 4. Proporre uno standard di misurazione e rappresentazione del protagonismo umano, esaustivo e coerente con le diverse prospettive di conoscenza e valutazione espresse dai differenti stakeholder dei progetti di sviluppo. 5. Implementare un prototipo software del sistema di misura e rappresentazione. <p>Contesto del progetto. Il contesto empirico del progetto è costituito dai programmi di sostegno a distanza realizzati in Uganda, le cui architetture multilivello combinano supporto educativo, accompagnamento psicosociale e sviluppo dei mezzi di sussistenza. Il contesto risulta essere particolarmente adatto, per osservare come il protagonismo umano si manifesti nelle famiglie coinvolte, chiamate a partecipare attivamente ai percorsi educativi dei figli e alle strategie di miglioramento delle proprie condizioni di vita, per costruire</p>

	<p>traiettorie di uscita dalla povertà, in contesti segnati da migrazione forzata e vulnerabilità strutturale.</p> <p>ENG: Introduction. Contemporary reflection on evaluation in development projects is increasingly characterized by the use of economic and operational indicators. This approach prioritizes the measurability and comparability of results, which in development practice are used not only as analytical tools, but also as criteria for comparing different interventions and as accountability mechanisms vis-à-vis funding bodies. However, the standard measurement framework adopted in development projects tends to overlook the assessment of the “internal” impact of interventions on the human subject—namely, the capacity to recognize oneself and to act as an active and responsible agent in one’s individual and collective trajectory. This dimension, despite being the decisive outcome for the sustainability of interventions, is rarely addressed in a systematic way. In the absence of adequate measurement tools, this key factor of development—here referred to as human protagonism—remains confined to a marginal or purely descriptive level, entrusted to qualitative observation or to the professional judgment of practitioners, without becoming a structural component of the processes of design, implementation, and evaluation of development interventions.</p> <p>Project Objectives.</p> <p>The project is situated at the intersection of human development, psychometrics, and statistics, and pursues the following objectives:</p> <ol style="list-style-type: none"> 1. To conceptualize and define the construct of human protagonism, identifying its dimensions and drivers and designing a corresponding measurement model. 2. To construct measurement scales for the dimensions of human protagonism. 3. To develop systems for synthesizing indicators at both the individual pillar level and the overall construct level, using both classical approaches—based on reflective or formative latent variable models and composite indicators—and more recent non-aggregative synthesis methodologies that have emerged in the statistical literature in recent years, with particular reference to algorithms grounded in partial order theory. The synthesis system will include both the development of unidimensional indicators and the design of multidimensional representations, in order to complement intensity measures with tools for the description and analysis of patterns. 4. To propose a standard for the measurement and representation of human protagonism that is comprehensive and consistent with the different perspectives of knowledge and evaluation expressed by the various stakeholders involved in development projects. 5. To implement a software prototype of the measurement and representation system. <p>Project Context. The empirical context of the project consists of distance-support programs implemented in Uganda whose multilevel architecture integrate educational support, psychosocial accompaniment, and livelihood development. This provides a particularly suitable context for observing how human protagonism manifests itself within participating families, who are called upon to take an active role both in their children’s educational pathways and in strategies aimed at improving their living conditions, in order to build pathways out of poverty in contexts marked by forced migration and structural vulnerability.</p>
Tutor	to be defined
Abroad period	to be defined
Specific rules	no specific rules

Strategic Innovation for Sustainable and Smart Ecosystems
134R

Progetto di ricerca Research project	ENG: <i>Socio-economic impact of delayed diagnosis of CRM diseases (PROG.8)</i>
Tipo/Type	Borse finanziate da aziende convenzionate / Scholarships funded by partner companies
Finanziatore Funding Body	Boehringer Ingelheim Italia S.p.A.
Borse/Scholarships	1
Abstract	ENG: The increase in life expectancy over the past twenty years has led to a significant rise in cardio-renal-metabolic (CRM) diseases, despite advances in research in this field. The management of chronic conditions represents a major challenge that the healthcare system will face in the coming years, a challenge made even more pressing by the high prevalence of these diseases and the considerable social and economic burden they impose. Although CRM diseases are well recognised, diagnostic delays remain a critical issue in conditions such as MASH (Metabolic Dysfunction-associated Steatohepatitis), chronic kidney disease, and heart failure with preserved ejection fraction. A late diagnosis, often resulting from a lack of awareness among both healthcare professionals and the general population, not only worsens the disease burden but also significantly increases public health expenditure. Furthermore, delayed diagnosis often results in patients presenting with more advanced disease stages, requiring more intensive and costly interventions, and experiencing a reduced quality of life. Early identification and intervention can help prevent complications, reduce hospital admissions, and improve long-term outcomes for patients. Therefore, investing in education, screening programmes, and the integration of multidisciplinary care pathways is essential to address this issue effectively and to mitigate the socio-economic impact associated with CRM diseases. This project aims to conduct an in-depth analysis of the current state of the art concerning early diagnosis, patient journey, clinical management, associated healthcare costs, and resource utilization, with particular focus on real-world scenarios. The objective is to provide a detailed and up-to-date overview that can support strategic decisions aimed at improving the quality of care and optimizing the use of healthcare resources.
Tutor	Tutor Unimib: Prof. Paolo Cortesi Supervisor Unimib: Prof. Lorenzo Mantovani Supervisor Boehringer: Dr. Marianna Festa
Abroad period	to be defined
Specific rules	no specific rules

Strategic Innovation for Sustainable and Smart Ecosystems
134R

Progetto di ricerca Research project	ENG: <i>Responsible AI for real-time monitoring, verifiability assessment, and explainable market-impact analysis of financial news (PROG.9)</i>
Tipo/Type	Borse finanziate da aziende convenzionate / Scholarships funded by partner companies
Finanziatore Funding Body	Intesa San Paolo S.p.a.
Borse/Scholarships	1
Abstract	<p>ENG: Financial institutions increasingly rely on real-time news flows to monitor market conditions and support investment and risk decisions, yet the information environment is affected by speculation, unverifiable claims, and narrative distortions that can materially influence market expectations. This project proposes a Responsible AI system for real-time monitoring, verifiability assessment, and explainable market-impact analysis of financial news, designed to be deployable in a banking setting. The core contribution is an end-to-end architecture that ingests news streams (e.g., open press articles and, in later stages, subscription-based press news), performs claim-centric parsing (entities, events, quantitative assertions), and assigns each claim a verifiability label (verified, unverifiable/speculative, contradicted) with calibrated confidence. The labeling component combines retrieval-based evidence gathering from trusted sources with LLM-based reasoning under explicit constraints to reduce hallucinations and to distinguish “not enough evidence” from “false.” To move beyond static fact checking, the system couples verifiability signals with market monitoring by aligning news narratives and claim dynamics to asset-level and sector-level responses, producing a lightweight impact score (directional relevance, novelty, uncertainty) and identifying anomalies such as sudden narrative shifts, coordinated rumor patterns, or inconsistent quantitative statements. A primary research focus is explainability and accountability: the project will develop explanation artifacts suitable for analysts and relationship managers, including evidence traces, counterfactual claim rewrites, and attribution of which textual elements drove verifiability and impact assessments. In parallel, the study will conduct a comparative bias and robustness audit across multiple foundation models (for example, different providers and open models) to quantify how verifiability judgments and narrative framing vary by model, language, and topic, emphasizing financial-domain neutrality and governance requirements. Evaluation will combine (i) expert-labeled subsets of press-review items, (ii) automatic consistency checks across sources, and (iii) retrospective event studies that relate system outputs to market reactions, with careful controls for confounding factors and time leakage. The expected outcome is a Responsible AI “news co-pilot” that helps practitioners rapidly separate verified information from speculation, understand the confidence and evidence behind each assessment, and monitor how news narratives may affect financial markets.</p>
Tutor	Dr. Andrea Cosentini
Abroad period	to be defined
Specific rules	no specific rules

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Progetto di ricerca Research project	ENG: <i>Fast UV–Vis spectroscopy for monitoring and controlling plasma detachment in fusion reactors (PROG.10)</i>
Tipo / Type	Borse finanziate da aziende convenzionate / Scholarships funded by partner companies
Finanziatore Funding Body	Eni S.p.a.
Borse/Scholarships	1
Abstract	ENG: This PhD project is focused on the design and construction of a fast ultraviolet–visible Czerny–Turner spectrometer system aimed at monitoring and controlling plasma detachment in a tokamak. The initial phase of the work involves the optical and mechanical design of a Czerny–Turner spectrometer configuration optimized for high spectral resolution and fast temporal response. The spectrometer will be then constructed and calibrated at the University of Milano-Bicocca and experimentally validated on existing fusion devices, where feasible, to assess its performance under realistic plasma and operational conditions. Possible test platforms include machines such as ASDEX Upgrade, MAST-U, or other relevant tokamaks, providing an opportunity to benchmark the diagnostic against established measurements and to demonstrate its applicability to present-day experiments. The successful implementation of this spectrometer system will provide fast time-resolved spectroscopic measurements essential for controlling plasma detachment and mitigating extreme heat loads on the divertor plates, addressing one of the critical challenges for the operation of next-generation fusion reactors.
Tutor	Tutor Unimib: Prof. Marco Cavedon Supervisor ENI S.p.A. : Dr. Erik Gallo (co-tutor: Dr. Silvia Vanellone)
Abroad period	no specific rules
Specific rules	Intellectual property clauses agreed with the Company apply to this scholarship

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Progetto di ricerca Research project	ENG: <i>Mechanistic Investigation of a Patented Calcium Silicate-Based Delivery Technology (PROG.11)</i>
Tipo/Type	Borse finanziate da aziende convenzionate / Scholarships funded by partner companies
Finanziatore Funding Body	Lea Cares
Borse/Scholarships	1
Abstract	<p>ENG: This project aims to investigate the mode of action of a patented calcium silicate-based delivery technology through controlled laboratory studies. The research will focus on release characteristics, diffusion processes, and measurable biological effects associated with the technology.</p> <p>The work will include release studies under defined experimental conditions, diffusion and transport analyses, and cell-based assays to evaluate biological responses. The project will assess how the technology influences cellular behavior and functional outcomes in controlled experimental systems. The objective is to clarify the mechanisms underlying the observed effects of the technology and to provide a scientific basis that complements ongoing preclinical and clinical research.</p>
Tutor	<p>Tutor Unimib: Prof. Francesco Peri</p> <p>Supervisor Unimib: Prof. Marco Giustra</p> <p>Supervisor Lea Cares: Dr. Gry Hulsart Billström</p>
Abroad period	to be defined
Specific rules	no specific rules

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Progetto di ricerca Research project	ENG: <i>Investigation of surface modification strategies for the enhancement of rubber performances (PROG.12)</i>
Tipo/Type	Borse finanziate da enti esterni / Scholarships funded by external organizations
Finanziatore Funding Body	Consorzio CORIMAV-PIRELLI TYRE
Borse/Scholarships	1
Abstract	ENG: The performances of rubber materials are strictly governed not only by their bulk composition but also by their surface features and operating environment. In particular, the characteristics of the materials they are in contact with and the corresponding interphase phenomena play a fundamental role in defining their final performances. For the development of a tyre, all these aspects must be taken into account in order to guarantee high performances and, at the same time, respect safety standards. In this context, the research activity will be focused on the study and the development of surface modification strategies which could potentially improve rubber articles features. Different approaches for the modification of rubber surface topography and the introduction of additional chemical functionalities by physical or chemical treatments have been already reported in literature. However, many challenges lie ahead given that most of these strategies show different complexities which hinder their industrial feasibility. In addition, in many applications surface modifications lack stability and tend to wear off with usage with a consequently limited lifespan. This project will be therefore the occasion to investigate deeply interfacial phenomena and identify the key parameters to control in order to implement the design of rubber materials in real-world applications.
Tutor	Prof. Carlo Antonini (Supervisor); Dr. Irene Tagliaro (Co-supervisor); Prof. Barbara Di Credico (Tutor) Pirelli Tutors: Dr. Elisa Manzini, Dr. Stefano Avolio.
Abroad period	6 months
Specific rules	Intellectual property clauses agreed with the Company apply to this scholarship

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Progetto di ricerca	ITA: <i>Impatto di terapie innovative e di percorsi di cura integrati sugli esiti clinici, sociali ed economici in malattie pneumologiche e reumatologiche misdiagnosticate. (BOEHRINGER.1)</i>
Research project	ENG: <i>Impact of novel therapies and integrated care pathways on clinical, social and economic outcomes in misdiagnosed pneumological and rheumatological diseases. (BOEHRINGER.1)</i>
Tipo/Type	Dipendenti Boehringer Ingelheim Italia S.p.A./ Employees Boehringer Ingelheim Italia S.p.A.
Posti/Position	1
Abstract	<p>ITA: Nonostante i notevoli progressi negli ultimi decenni nella gestione clinica e nel trattamento delle principali malattie pneumologiche e reumatologiche, alcuni bisogni significativi rimangono insoddisfatti per molti pazienti che soffrono di condizioni diagnosticate erroneamente. Questo è particolarmente marcato per le persone colpite da malattie rare, poco riconosciute o mal gestite, come, ad esempio, la fibrosi polmonare, le bronchiectasie o la sclerosi sistemica. In questi casi, infatti, ci sono questioni rilevanti, come una diffusa mancanza di consapevolezza, differenze significative nei percorsi di assistenza dei pazienti tra centri con vari livelli di competenza e lacune gestionali, che insieme portano a diagnosi ritardate o completamente mancate, sottotrattamento e scarsa qualità della vita. Queste lacune contribuiscono a un notevole carico di malattia, aumentano i costi della sanità pubblica e perpetuano disuguaglianze nell'accesso all'assistenza sanitaria per un vasto numero di pazienti, anche con notevoli differenze geografiche in tutta Italia. Questo progetto mira a valutare, in contesti reali, lo stato dell'arte attuale della gestione clinica e dei costi sanitari correlati, nonché l'impatto delle innovazioni terapeutiche e di percorsi di cura ottimizzati sugli esiti clinici e sociali, sui costi sanitari e sull'utilizzo delle risorse, in malattie pneumologiche e reumatologiche spesso mal gestite come la fibrosi polmonare, la bronchiectasie e la sclerosi sistemica.</p> <p>ENG: Despite significant advancements over last decades in clinical management and treatment of major pneumological and rheumatological diseases, substantial unmet needs remain unaddressed for many patients who experience misdiagnosed conditions. This is particularly pronounced for individuals affected by rare, underrecognized or mismanaged diseases such as, for example, pulmonary fibrosis, bronchiectasis, and systemic sclerosis. In these cases, in fact, there are relevant issues, such as a widespread lack of awareness, significant differences in patient care pathways across centers with various levels of expertise and policy gaps, that all together lead to delayed or entirely missed diagnosis, undertreatment and poor quality of life. These gaps contribute to a considerable disease burden, increase public health costs and perpetuate inequities in healthcare access for a vast number of patients, also with notable geographical differences across Italy. This project aims to evaluate, in real-world settings, the current state-of-the art of clinical management and related healthcare costs, as well as the impact of therapeutic innovations and optimized patient care pathways on clinical and social outcomes, healthcare costs and resource utilization, in frequently mismanaged pneumological and rheumatological diseases such as pulmonary fibrosis, bronchiectasis, and systemic sclerosis.</p>
Tutor	Tutor Unimib: Prof. Paolo Cortesi; Supervisor Unimib: Prof. Lorenzo Mantovani Supervisor Boehringer: Dr. Chiara Paglino
Abroad period	to be defined

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Progetto di ricerca Research project	<p>ITA: <i>Biodiversità e coesione sociale nei territori mediterranei: modelli integrati di monitoraggio e gestione del capitale naturale per uno sviluppo umano sostenibile (AVSI.1)</i></p> <p>ENG: <i>Biodiversity and Social Cohesion in Mediterranean Territories: Integrated Monitoring and Natural Capital Governance Models for Sustainable Human Development (AVSI.1)</i></p>
Tipo/Type	Dipendenti Fondazione AVSI - ETS / Employees Fondazione AVSI - ETS
Posti/Position	1
Abstract	<p>ITA: Nonostante l'ampia produzione scientifica in materia di conservazione della biodiversità, ripristino ecologico e gestione delle aree protette, persistono rilevanti lacune teoriche e metodologiche. In primo luogo, la letteratura si è prevalentemente concentrata sulla valutazione di interventi di successo, mentre risultano scarsamente sistematizzate le evidenze relative a insuccessi, effetti inattesi o pratiche inefficaci. Tale bias selettivo limita la possibilità di apprendimento cumulativo e ostacola la costruzione di modelli adattivi realmente evidence-based. Una ricerca che analizzi in modo comparativo anche le "failure trajectories" degli interventi di incremento della biodiversità può contribuire in modo sostanziale al progresso delle strategie di gestione adattiva. In secondo luogo, molti studi presentano una debolezza temporale: il monitoraggio è spesso limitato al breve periodo e non consente di valutare la stabilità ecologica e la resilienza degli ecosistemi nel medio-lungo termine. In contesti mediterranei, caratterizzati da elevata variabilità climatica e pressione antropica, risulta invece cruciale sviluppare disegni di ricerca longitudinali capaci di misurare dinamiche evolutive, trade-off e soglie critiche di trasformazione. In terzo luogo, permane una separazione analitica tra dimensione ecologica e dimensione socio-economica. La conservazione della biodiversità viene frequentemente trattata come obiettivo ambientale autonomo, mentre la letteratura sull'impatto sociale tende a non integrare in modo rigoroso indicatori ecologici misurabili. Mancano pertanto modelli interdisciplinari che colleghino sistematicamente variazioni nella biodiversità, fornitura di servizi ecosistemici e indicatori di benessere, resilienza territoriale e coesione sociale. In particolare, l'accettazione sociale degli interventi e il ruolo delle comunità locali nei processi di governance ecologica risultano ancora sottostudiati in termini quantitativi e comparativi. Infine, sebbene le tecnologie di monitoraggio avanzato (sensoristica automatizzata, bioacustica, environmental DNA metabarcoding, analisi tramite intelligenza artificiale) siano in rapida espansione, la loro integrazione in framework valutativi orientati alle politiche pubbliche e alla pianificazione territoriale è ancora frammentaria. Manca una riflessione sistematica su come tali strumenti possano migliorare non solo la precisione ecologica, ma anche la qualità decisionale nei processi di sviluppo sostenibile. La ricerca proposta intende colmare tali lacune attraverso lo sviluppo di un modello integrato che:</p> <ul style="list-style-type: none"> (i) analizzi comparativamente successi e insuccessi degli interventi; (ii) adotti un approccio longitudinale al monitoraggio della biodiversità; (iii) integri indicatori ecologici e socio-economici in un unico quadro analitico; (iv) sperimenti l'utilizzo combinato di metodi tradizionali e tecnologie avanzate in funzione della pianificazione territoriale. <p>Il contributo atteso non è soltanto empirico, ma teorico-metodologico: la costruzione di un framework interdisciplinare replicabile per valutare la biodiversità come leva di sviluppo umano sostenibile nei contesti mediterranei.</p> <p>ENG: Despite the extensive body of scientific literature on biodiversity conservation, ecological restoration, and protected area management, significant theoretical and methodological gaps persist. First, existing scholarship has predominantly focused on evaluating successful interventions, while evidence concerning failures, unintended</p>

	<p>consequences, or ineffective practices remains insufficiently systematized. This selective bias constrains cumulative learning and limits the development of genuinely evidence-based adaptive management models. Research that comparatively analyzes the “failure trajectories” of biodiversity enhancement interventions could substantially advance adaptive governance strategies by identifying context-specific constraints, trade-offs, and institutional weaknesses. Second, many studies suffer from temporal limitations: monitoring efforts are frequently confined to the short term, thereby precluding robust assessment of ecological stability and ecosystem resilience over medium- to long-term horizons. In Mediterranean contexts— characterized by high climatic variability, anthropogenic pressures, land-use fragmentation, and increasing wildfire risk—longitudinal research designs are essential to capture evolutionary dynamics, ecological tipping points, and systemic trade-offs between conservation and development objectives. Third, an analytical divide persists between ecological and socio-economic dimensions. Biodiversity conservation is often treated as a self-contained environmental objective, while social impact research rarely integrates measurable ecological indicators in a systematic manner. As a result, interdisciplinary models capable of linking biodiversity variation, ecosystem service provision, and indicators of well-being, territorial resilience, and social cohesion remain underdeveloped. In particular, societal acceptance of conservation measures and the role of local communities in ecological governance processes are still insufficiently examined through rigorous quantitative and comparative approaches. Finally, although advanced monitoring technologies—such as automated sensor systems, bioacoustic monitoring, environmental DNA (eDNA) metabarcoding, and artificial intelligence– supported data analysis—are rapidly evolving, their integration into policy-oriented evaluation frameworks and territorial planning processes remains fragmented. A systematic reflection is lacking on how such tools can enhance not only ecological accuracy but also decision-making quality within sustainable development strategies. The proposed research seeks to address these gaps through the development of an integrated analytical model that:</p> <ul style="list-style-type: none"> (i) comparatively examines both successful and unsuccessful biodiversity interventions; (ii) adopts a longitudinal approach to biodiversity monitoring; (iii) systematically integrates ecological and socio-economic indicators within a unified analytical framework; and (iv) experiments with the combined use of traditional field-based methods and advanced monitoring technologies to inform territorial governance and planning. <p>The expected contribution is not merely empirical but theoretical and methodological: the construction of a replicable interdisciplinary framework for assessing biodiversity as a strategic lever for sustainable human development in Mediterranean contexts.</p>
Tutor	to be defined
Abroad period	to be defined
Specific rules	no specific rules

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Progetto di ricerca Research project	ENG: <i>Rebalancing Power in Agribusiness Public–Private Partnerships: Cooperative Agency and Equity-Based Institutional Design in East Africa</i> (AVSI.2)
Tipo/Type	Dipendenti Fondazione AVSI - ETS / Employees Fondazione AVSI - ETS
Posti/Posizioni	1
Abstract	<p>ENG: Public–Private Partnerships (PPPs) have emerged as a central governance instrument for advancing the Sustainable Development Goals (SDGs), particularly in the agricultural sector across Sub-Saharan Africa. In East Africa, agribusiness PPPs are widely promoted as mechanisms for integrating smallholder farmers into global value chains, enhancing productivity, and attracting private investment. Yet growing empirical evidence suggests that these arrangements frequently reproduce structural power asymmetries between states, multinational corporations (MNCs), and local producer cooperatives. Rather than generating inclusive development, such partnerships often result in forms of adverse incorporation, risk externalization, and elite capture, whereby smallholders contribute land, labor, and social capital while value appropriation and strategic control remain concentrated in corporate actors. Despite increasing scholarly attention to inclusive value chains and responsible investment frameworks, three significant gaps remain in the literature. First, research on agribusiness PPPs has largely focused on performance metrics—such as productivity gains, market access, and investment mobilization—while under-theorizing intrapartnership power dynamics and bargaining asymmetries. Producer cooperatives are frequently conceptualized as delivery mechanisms rather than as collective political and economic actors with agency. Second, there is a limited integration between cooperative governance theory, institutional bargaining theory, and global value chain (GVC) analysis. While cooperative scholarship emphasizes democratic governance and social capital, it rarely examines whether and how these attributes translate into effective contractual leverage vis-à-vis capital-intensive private firms. Conversely, GVC and institutional economics frameworks tend to analyze power concentration and lead-firm dominance without sufficiently exploring cooperative-based countervailing power mechanisms. Third, the literature lacks a systematic evaluation of multipartite governance arrangements (Public–Private–Cooperative–NGO configurations) and equity-based institutional innovations designed explicitly to rebalance bargaining power. Mechanisms such as hybrid ownership models, legally mandated protective clauses, collective equity recognition, or digital transparency tools (e.g., blockchain-enabled traceability) remain underexamined in terms of their capacity to reduce information asymmetries and safeguard cooperative agency. The proposed research seeks to address these gaps by developing an analytical framework for assessing how equity-based governance models can mitigate structural power asymmetries in agribusiness PPPs in East Africa. The central research question guiding the study is: How can cooperative governance structures be institutionally designed or strengthened to preserve agency and bargaining power when engaging with significantly more resource-endowed private actors? The study aims to generate three core contributions. Theoretically, it will integrate insights from New Institutional Economics, collective action theory, and global value chain governance to conceptualize a “power-balanced PPP” model. Empirically, it will examine comparative cases of cooperative-inclusive PPPs to identify institutional mechanisms that successfully prevent elite capture and adverse incorporation. Normatively, it will inform policy debates by proposing institutional design principles capable of recognizing collective agency as a functional form of equity within large-scale agricultural investments. At a time when PPPs are increasingly positioned as the dominant architecture of agricultural development, advancing a rigorous understanding of power, governance, and institutional design within these arrangements is both a scholarly and policy imperative.</p>

Tutor	to be defined
Abroad period	to be defined
Specific rules	no specific rules

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Progetto di ricerca Research project	ENG: <i>Process Innovation through AI Governance: A Data-Driven Framework for Responsible Decision-Making in Complex Organizations (INTESA.1)</i>
Tipo/Type	Dipendenti Intesa San Paolo S.p.a./ Employees Intesa San Paolo S.p.a.
Posti/Positions	1
Abstract	<p>ENG: The enactment of the AI Act represents a significant turning point for the organisation which are dedicated to the development and adoption of AI systems. Big companies are nowadays employed into the development of new routes of implementation of the normative, not only challenging the technical and legal conformity, but also the managing of the organisational transformation, the resources allocation and the coordination of heterogeneous functions. Within this framework, it is evident the importance of the project management as a strategic discipline which is able to provide the necessary operative structure for the translation of the AI demands into governable and measurable business processes. In complex organisations, where millions of people are directly involved into the use of high risk AI systems such as the credit scoring, this necessarily becomes quite apparent. The compliance of such systems require a structured approach which involves the whole project lifecycle: from the mapping and classification of the AI existing system through risk criteria defined by the normative, to the coordination of an heterogeneous team made up of legal functions, compliance ones, data science and business too, ensuring the respect of the deadlines and the strategic alignment through planning tools, risk registers and conformity milestones. However, the research offers a further prospect: the view of the AI governance not only as an object to reach through the project management, but as an operative value that enables the improvement and retroalimentionation of the project management itself. The AI Governance solutions, such as the bias detection system, the model monitoring, explainability and risk scoring, carry out a double function in this process. On one hand they represent the tool through which the companies continuously keep track of the already classified AI systems, identifying immediately deviations of the performance, anomalies or eventual violation of the conformity. On the other hand, the metrics and the signals produced by these struments are enrolled to become direct inputs for the project manager, supporting concrete decisions during the execution of the project, like the managing of time and the release plan, the reallocation of the sources in return to emerging concerns and the escalation towards the senior management or the governance committees. Thereby, the research aims to explore the bidirectional relation between the project management and the AI governance, by referring specifically to the complex and big organisations. For the methodologies, the research offers an approach developed on two levels: the first one refers to the development of a theoretical model which formalises the interaction points between the p.m and the AI G., identifying a way to integrate systematically the results and metrics produced by the governance tools; the second level instead refers to the validation of the model through a case study conducted into a corporate environment, in which the implementation of the AI is already underway and the AI G, tools already adopted, such to allow the observation of the dynamics between the normative conformity, the project management and the use of governance instruments for the competitive sustainable advantage.</p>
Tutor	to be defined
Abroad period	to be defined
Specific rules	no specific rules

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Progetto di ricerca Research project	ENG: <i>Responsible AI Methodologies for Multimodal Systems (INTESA.2)</i>
Tipo/Type	Dipendenti Intesa San Paolo S.p.a./ Employees Intesa San Paolo S.p.a.
Posti/Positions	1
Abstract	<p>ENG: Artificial Intelligence (AI) systems are increasingly integrated into industrial applications for automation and decision-support. The recent enactment of the European Union Artificial Intelligence Act (EU AI Act) mandates that these systems comply with strict standards of transparency, robustness, fairness, explainability and safety. Consequently, Responsible and Trustworthy AI is now a regulatory and industrial necessity; companies must assess, document, and mitigate risks throughout the entire AI lifecycle to maintain public trust and ensure compliance. Responsible AI research has achieved notable advancements in unimodal black-box systems. Existing approaches include mechanistic interpretability techniques for explainability, guardrails for safety monitoring, and fairness-aware training to mitigate bias. However, Responsible AI remains an active, evolving field with continuously maturing evaluation methodologies. These challenges become more complex in the emerging paradigm of multimodal AI. Modern systems increasingly integrate heterogeneous data sources such as text, images, audio, and structured data, to better reflect real-world scenarios. In these architectures, inputs are jointly encoded and fused within shared representation spaces. This fusion fundamentally alters how concepts are learned and utilized by the models. The specific role and influence of each modality within these shared spaces become a critical area of investigation. A systematic study is required to determine how bias propagates across modalities, whether certain modalities dominate the encoding of sensitive attributes, and to what extent modality fusion amplifies unsafe or spurious correlations that would not manifest in unimodal systems. Furthermore, multimodal models exhibit unique vulnerabilities, where robustness, fairness, and interpretability fluctuate depending on which input modality is perturbed, partially missing (via masking approaches), or adversarially manipulated. Addressing these vulnerabilities requires developing methodologies capable of isolating each modality's contribution to model behavior, analyzing how internal representations shift under multimodal paradigms, and quantifying how Responsible AI monitoring must evolve when heterogeneous inputs are combined.</p>
Tutor	to be defined
Abroad period	to be defined
Specific rules	no specific rules

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Progetto di ricerca Research project	ENG: <i>A Guardian Agent Framework for Proactive Oversight in Multi-Agent Systems (INTESA.3)</i>
Tipo/Type	Dipendenti Intesa San Paolo S.p.a./ Employees Intesa San Paolo S.p.a.
Posti/Posizioni	1
Abstract	<p>ENG: The proliferation of autonomous agents in shared environments presents significant challenges in ensuring system stability, fairness, security, and optimal outcomes. This research proposes the development and analysis of a Guardian Agent framework designed to regulate both individual and multi-agent systems through autonomous and proactive intervention strategies. Unlike traditional deterministic controllers that simply permit or deny actions, Guardian Agents operate as intelligent and self-directed systems that dynamically observe inter-agent interactions and autonomously determine when and how to modify action flows and information exchange to guide the system towards desired outcomes. In this way, Guardian Agents help the system prevent failures and enhance overall efficiency. A central investigation of this research centers on the architectural design that addresses the question of whether Guardian Agent functionalities are best implemented as a distributed system across multiple guardian nodes or as a centralized single-agent architecture. This comparative analysis will examine trade-offs in scalability, robustness, computational efficiency, and response under system loads and failure scenarios. An additional potential area for investigation involves addressing fairness in multi-agent environments. In such contexts, Guardian Agents could autonomously monitor system dynamics to proactively enforce equitable access to resources and prevent monopolistic behavior or corrupt coalitions. The proposed Guardian Agents present a paradigm shift from reactive to proactive multi-agent system governance, offering a comprehensive solution for maintaining system integrity while preserving agent autonomy and promoting equitable collaboration.</p>
Tutor	to be defined
Abroad period	to be defined
Specific rules	no specific rules

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Progetto di ricerca Research project	ENG: <i>Building Oversight by Design: Governance Architectures for HighRisk AI Systems (INTESA.4)</i>
Tipo / Type	Dipendenti Intesa San Paolo S.p.a./ Employees Intesa San Paolo S.p.a.
Posti/Positions	1
Abstract	<p>ENG: The rapid integration of Artificial Intelligence (AI) systems into decision-making processes across public and private sectors is profoundly transforming organizational structures, governance models, and the protection of individual rights. AI systems are no longer confined to experimental environments; they increasingly mediate access to employment, credit, healthcare and public services, therefore mediating fundamental opportunities. Within this evolving landscape, the European regulatory framework — most notably the Artificial Intelligence Act — identifies human oversight as one of the core safeguards for high-risk AI systems. Oversight is conceived as the mechanism capable of preventing or minimizing risks to fundamental rights, ensuring that automated systems remain under meaningful human control. However, despite its normative centrality, human oversight remains conceptually underdefined and operationally fragile. In many real-world deployments, it risks being reduced to a symbolic requirement: a human formally “in the loop” but lacking the information, authority, training, or structural conditions necessary to exercise genuine control. This gap between regulatory ambition and organizational practice creates a structural vulnerability in the AI governance ecosystem. From an industrial perspective, this challenge is particularly acute. Organizations — especially deployers relying on third-party providers or general-purpose AI systems — must comply with increasingly demanding regulatory obligations while managing operational efficiency, innovation cycles, and competitive pressures. In this context, oversight cannot be treated as an abstract ethical principle; it must be translated into processes, responsibilities, escalation mechanisms, and measurable governance structures. Empirical observations emerging from my previous research activities indicate that effective human oversight is the most decisive mitigating factor identified during Fundamental Rights Impact Assessments (FRIAs). Yet, organizations frequently lack structured methodologies to design, implement, and evaluate such oversight mechanisms. The result is a regulatory-implementation gap that risks undermining both compliance and the substantive protection of individuals. For these reasons, it becomes crucial to reconceptualize human oversight not merely as a legal requirement, but as a socio-technical infrastructure embedded within organizational ecosystems. This research aims to address that need by developing an operational, scalable, and industry-tested framework capable of transforming oversight from a formal obligation into an effective governance tool.</p>
Tutor	to be defined
Abroad period	to be defined
Specific rules	no specific rules

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Progetto di ricerca Research project	ENG: <i>Preclinical and Clinical Evaluation of a Patented Calcium Silicate-Based Delivery Technology for Hair, Skin and Nail Applications (LEACARES.1)</i>
Tipo / Type	Dipendenti Lea Cares / Employees Lea Cares
Posti/Positions	1
Abstract	ENG: This PhD project focuses on the preclinical and clinical evaluation of a patented calcium silicate-based delivery technology for applications in hair, skin, and nail health. The research will follow the continued development of the technological platform within an industrial context while maintaining a strong scientific foundation. The project will investigate formulation strategies, release kinetics, and diffusion behavior in relevant preclinical models. These studies will support the optimization of product formats and application conditions, as well as provide insight into stability, transport properties, and functional performance. In addition, preclinical assessments and clinical investigations will be conducted to evaluate safety and measurable biological and functional outcomes. The overall objective is to generate robust scientific evidence linking material performance, product development, and clinical effects.
Tutor	Tutor Unimib: Prof. Francesco Peri Supervisor Unimib: Prof. Miriam Colombo Supervisor Lea Cares: Dr. Gry Hulsart Billström
Abroad period	to be defined
Specific rules	to be defined

Tecnologie Convergenti per i Sistemi Biomolecolari (TeCSBi)

Converging Technologies for Biomolecular Systems (TeCSBi)

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Progetto di ricerca Research project	<p>ITA: <i>Caratterizzazione integrata del comportamento probiotico durante il transito gastrointestinale: analisi in vitro e approcci traslazionali (PROG.1)</i></p> <p>ENG: <i>Integrated characterization of probiotic functional behavior during gastrointestinal transit: in vitro analyses and translation approach (PROG.1)</i></p>
Tipo/Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	1
Abstract	<p>ITA: Il progetto di dottorato è finalizzato alla valorizzazione di probiotici già disponibili a livello industriale e allo sviluppo di nuove formulazioni mono- e multi-ceppo. L'attività si concentrerà sulla caratterizzazione funzionale di ceppi tradizionali (lattobacilli e bifidobatteri) e di microrganismi intestinali umani di nuova generazione, attraverso analisi genomiche comparative e studi metabolici mirati all'identificazione di determinanti rilevanti per l'interazione con l'ospite. Saranno condotti saggi preclinici in vitro ed ex vivo, nonché studi in vivo per valutare le performance biologiche e la robustezza funzionale dei ceppi. Particolare attenzione sarà dedicata agli effetti immunomodulatori e alla possibilità di integrare specifici probiotici con terapie farmacologiche, al fine di esplorarne l'impiego complementare in associazione a trattamenti convenzionali nella nutrizione e nella salute umana.</p> <p>ENG: The PhD project is aimed at enhancing the value of probiotic strains already available at the industrial level and at developing new single- and multi-strain formulations. The research activity will focus on the functional characterization of traditional strains (lactobacilli and bifidobacteria) as well as next-generation human gut microorganisms, through comparative genomic analyses and targeted metabolic studies aimed at identifying determinants relevant to host interaction. Preclinical in vitro and ex vivo assays will be conducted, together with in vivo studies, to assess the biological performance and functional robustness of the strains. Particular attention will be devoted to immunomodulatory effects and to the possibility of integrating selected probiotics with pharmacological therapies, in order to explore their complementary use in combination with conventional treatments in nutrition and human health.</p>
Tutor	prof. Simone Guglielmetti
Abroad period	to be defined
Specific rules	to be defined

Tecnologie Convergenti per i Sistemi Biomolecolari (TeCSBi)
Converging Technologies for Biomolecular Systems (TeCSBi)

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Progetto di ricerca Research project	ENG: <i>Uncovering the hidden aspects of temperature adaptation by resurrecting ancestral enzymes: from evolutionary history to biotechnology (PROG.2)</i>
Tip /Type	Borse finanziate dal Dipartimento / Scholarships funded by the Department
Borse/Scholarships	2
Abstract	<p>ITA: La biocatalisi svolge un ruolo chiave nello sviluppo di processi sostenibili. Tuttavia, persiste una sfida significativa: la limitata attività e stabilità degli enzimi alle tipiche temperature di processo. Sebbene la scoperta di nuovi enzimi abbia ampliato il repertorio di biocatalizzatori attivi a diverse temperature, gli enzimi naturali raramente soddisfano i requisiti dei processi biotecnologici senza interventi di ingegneria proteica. Comprendere i meccanismi di adattamento alle alte e alle basse temperature è essenziale per ingegnerizzare enzimi in grado di funzionare in condizioni di temperatura non naturali, consentendone l'uso nella biocatalisi. Questo progetto propone un approccio innovativo che integra la ricostruzione di sequenze ancestrali e tecniche di deep learning per il design di enzimi allo scopo di sviluppare biocatalizzatori con le proprietà termiche desiderate. Gli obiettivi specifici sono: i) decifrare i meccanismi molecolari e i determinanti strutturali dell'adattamento termico in una famiglia di enzimi idrolitici; ii) sfruttare le conoscenze acquisite per la progettazione di nuovi enzimi, attraverso approcci di deep learning; iii) testare il potenziale degli enzimi progettati in applicazioni biotecnologiche. Questo approccio può aprire nuove possibilità per la progettazione di enzimi innovativi, combinando ricerca di base e applicazioni biotecnologiche.</p> <p>ENG: Biocatalysis plays an increasingly vital role in advancing sustainable processes. However, a significant challenge persists: the limited activity and stability of enzymes at typical process temperatures. Although enzyme discovery efforts have expanded the repertoire of biocatalysts active at different temperatures, natural enzymes rarely meet the requirements of biotechnological processes. Understanding the mechanisms of temperature adaptation is essential for engineering enzymes with tailored thermal properties suitable for biocatalysis. This project proposes an innovative evolutionary-based approach that integrates ancestral sequence reconstruction and deep learning structure-based techniques to develop enzymes with tailored properties. The specific objectives are as follows: i) deciphering the molecular mechanisms and structural determinants of thermal adaptation in a family of hydrolytic enzymes; ii) exploiting the knowledge on structural basis of thermal adaptation to develop a deep learning-based framework for enzyme design; and iii) validating the potential of the designed enzymes in biotechnological applications. This approach may open new possibilities for designing novel enzymes, combining basic research and biotechnology applications.</p>
Tutor	To be defined
Abroad period	To be defined
Specific rules	no specific rules

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Converging Technologies for Biomolecular Systems (TeCSBi)

117R

Progetto di ricerca Research project	ENG: <i>The Role of Non-coding RNA in Lung Cancer Progression and Chemo-Immunotherapy Response (PROG.3)</i>
Tipo/Type	Contratti di apprendistato di alta formazione / High-level apprenticeship contracts
Azienda/Company	Fondazione “Casa Sollievo della Sofferenza” - Opera di San Pio da Pietrelcina, Istituto di Ricovero e Cura a Carattere Scientifico
Posti/Positions	1
Abstract	ENG: Lung cancer remains the leading cause of cancer-related mortality worldwide, largely due to disease progression and variable responses to systemic therapies. In recent years, chemo-immunotherapy has become a standard of care for many patients with locally-advanced and advanced non-small cell lung cancer (NSCLC); however, primary and acquired resistance remain major clinical challenges. Emerging evidence indicates that non-coding RNAs (ncRNAs), including microRNAs, play a central role in regulating tumor cell plasticity, immune evasion, and therapeutic response. This work explores the contribution of ncRNAs to lung cancer progression and response to chemo-immunotherapy through their dynamic interaction with the lung cancer transcriptome and the tumor immune microenvironment. We highlight how ncRNAs modulate key oncogenic and immune-related pathways, including interferon signaling, antigen presentation, immune checkpoint regulation, and cancer cell plasticity. In particular, ncRNA-mediated regulation of immune checkpoint molecules such as PD-L1 and interferon- γ -responsive programs emerges as a critical determinant of immunotherapy sensitivity. By integrating bulk and single-cell transcriptomics, spatial profiling, and functional validation, this study aims to identify ncRNA-driven regulatory networks that underlie tumor evolution and therapy resistance. Understanding these mechanisms will provide a framework for the development of ncRNA-based biomarkers to predict response to chemo-immunotherapy and may uncover novel therapeutic vulnerabilities to improve clinical outcomes for patients with lung cancer.
Tutor	UNIMIB: Prof. Daniela Ferrari, Dr. Fabrizio Bianchi Company Supervisor: Dr. Massimo Carella
Abroad period	no specific rules
Specific rules	ITA: Inquadramento previsto per l'apprendista tipologia contratto: apprendistato di III livello Inquadramento professionale di partenza: Collaboratore Professionale di Ricerca Sanitaria / D Inquadramento professionale d'arrivo: Ricercatore Sanitario / DS Numero ore settimanali: n.36 h settimanali dal lunedì al venerdì Retribuzione lorda annuale: - da 1° al 18 ° mese 70% della retribuzione pertinente alla qualifica da conseguire 18.721,045 euro lordi / 1.325,00 netti mese - dal 19° al 36° mese 90 % della retribuzione pertinente alla qualifica da conseguire

24.069,91 euro lordi / 1.702,00 netti mese

Retribuzione netta mensile:

- da 1° al 18 ° mese 70% della retribuzione pertinente alla qualifica da conseguire 1.325,00 netti mese
- dal 19° al 36° mese 90 % della retribuzione pertinente alla qualifica da conseguire 1.702,00 netti mese

ENG: Expected position for the apprentice

Contract type: Level III apprenticeship

Starting professional position: Professional Health Research Collaborator / D

Final professional position: Health Researcher / DS

Number of hours per week: 36 hours per week, Monday to Friday

Gross annual salary:

- from the 1st to the 18th month, 70% of the salary corresponding to the qualification to be obtained, €18,721.045 gross / €1,325.00 net per month
- from the 19th to the 36th month 90% of the remuneration corresponding to the qualification to be obtained €24,069.91 gross / €1,702.00 net per month

Net monthly remuneration:

- from the 1st to the 18th month 70% of the remuneration corresponding to the qualification to be obtained 1,325.00 net per month
- from the 19th to the 36th month 90% of the remuneration corresponding to the qualification to be obtained 1,702.00 net per month