# UNIVERSITÀ DEGLI STUDI DI FIRENZE
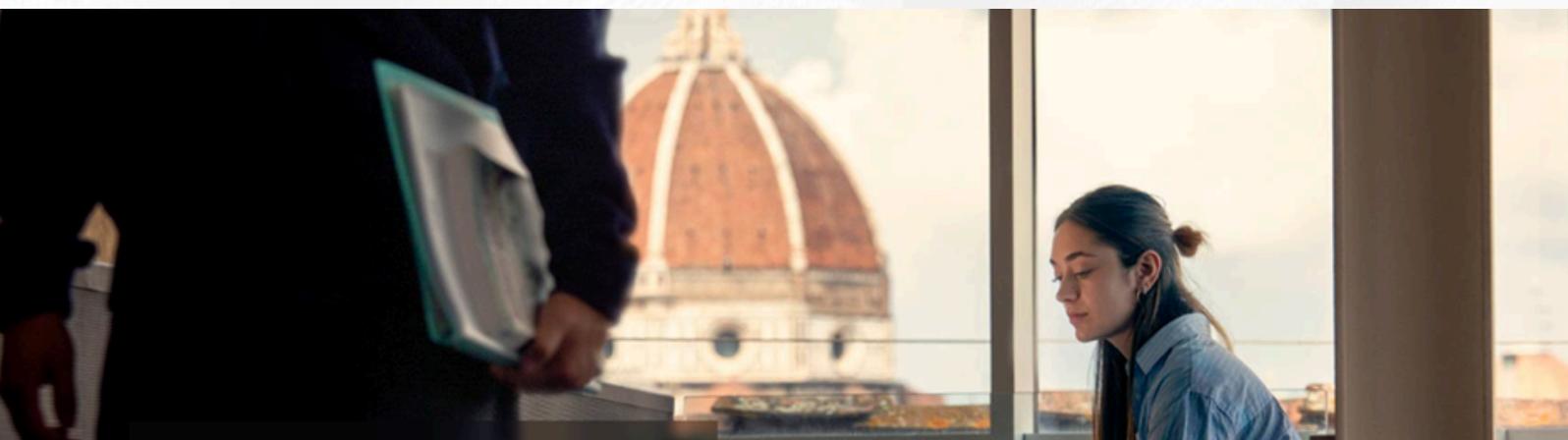
www.unifi.it

# Information sheet 2026

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# THE UNIVERSITY OF FLORENCE: ADVANCING RESEARCH, EMPOWERING TALENT

**An interdisciplinary academic environment supporting excellent research and the development of new scientific leadership**

## A TRADITION OF KNOWLEDGE, A VISION FOR INNOVATION

Founded in 1321, the **University of Florence** is one of the largest and most comprehensive public universities in Italy, combining a **long academic tradition** with a **strong commitment to innovation, interdisciplinary research, and international collaboration**.

UNIFI hosts a broad and integrated research ecosystem spanning Life Sciences, Physical and Engineering Sciences, Social Sciences and Humanities, with a strong orientation toward addressing major societal challenges through scientific excellence, interdisciplinarity, and knowledge transfer. The University's research environment encourages interaction between fundamental and applied science, fostering innovative approaches capable of generating scientific, technological, and societal impact while supporting the development of new research directions.

## AN INTERDISCIPLINARY RESEARCH ENVIRONMENT

The University is organized into a network of Departments distributed across several scientific campuses and interconnected through shared infrastructures and interdepartmental research centers. This structure promotes cross-disciplinary collaboration and enables researchers to operate within a dynamic environment where complementary expertise and advanced facilities support both frontier research and translational applications. The close interaction among disciplines encourages the exploration of emerging research areas and the development of ambitious, high-impact projects.

# EXCELLENCE IN COMPETITIVE RESEARCH

UNIFI researchers actively participate in major competitive funding programmes at national and international level, including Horizon Europe, European Research Council grants and Marie Skłodowska-Curie Actions, as well as collaborative initiatives developed with academic institutions, industry and public stakeholders worldwide. Several departments have received the Italian Ministry's "Departments of Excellence" recognition, reflecting sustained scientific productivity, international visibility, and long-term strategic investment in research development. This environment provides fertile ground for the development of innovative research ideas capable of evolving into competitive international projects.

# SUPPORTING RESEARCHERS: THE HRS4R COMMITMENT

The University of Florence has been awarded the **HR Excellence in Research (HRS4R)** recognition by the European Commission, confirming its commitment to the principles of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers. Through transparent recruitment procedures, support for career development and attention to working conditions, UNIFI promotes an open, inclusive and attractive research environment aligned with European standards and attentive to researchers at all career stages.

# SUPPORTING RESEARCH CAREERS AND SCIENTIFIC INDEPENDENCE

The University of Florence promotes a research environment designed to support scientists at key stages of their academic development, particularly during the transition toward research independence. Researchers benefit from close integration within established research groups, access to international networks, and institutional support for the development of ambitious research agendas and competitive funding proposals.

Within this framework, initiatives such as UNIFI4FUTURE aim to attract outstanding researchers and provide the conditions for consolidating independent research lines, strengthening international collaborations and fostering long-term academic growth.

# FROM RESEARCH TO SOCIETAL IMPACT

The University maintains strong and longstanding collaborations with hospitals, research institutes, cultural institutions and industrial partners, fostering innovation pathways and knowledge exchange across disciplines. Strategic research priorities include health and biomedical sciences, advanced materials and quantum technologies, sustainability and bioeconomy, digital transformation and artificial intelligence, as well as cultural heritage and social innovation, reflecting the University's commitment to addressing global challenges through research.



# A GLOBAL ACADEMIC ENVIRONMENT IN FLORENCE

Located in Florence, a city historically characterized by the intersection of culture, science and creativity, UNIFI offers an international and collaborative academic environment where researchers benefit from advanced infrastructures, interdisciplinary dialogue and dedicated institutional support for European research activities. The University aims to provide an environment in which talented researchers can develop independent research paths, strengthen international collaborations and transform innovative ideas into high-impact scientific initiatives within a supportive and globally connected academic community.

# DEPARTMENT OF EXPERIMENTAL AND CLINICAL MEDICINE

www.dmsc.unifi.it

The Department of Experimental and Clinical Medicine (DMSC) is one of the largest in the University of Florence.

The DMSC is composed of the following 7 Specialty Sections: Section of Anatomy and Histology; Specialist Surgery and Histopathological and Molecular Diagnostics; Health Services Research; Critical and Specialist Medicine; Internal Medicine; Physiological sciences.

The Department is home to 109 university professors , 63 senior researchers, 79 research assistants and 43 fellows. Our competent teaching and administrative staff form a compact and supportive community and are easily approachable.

Its purposes are carrying out scientific research, teaching, training and third mission activities; most members also perform clinical activities in the Careggi University hospital. The Department includes full and associate professors and researchers belonging to various scientific-disciplinary sectors representing the majority of areas of biomedical education and research.

The Department's objectives are:

- promote and coordinate research activity in the fields of Experimental and Clinical Medicine;
- improve and promote relationships and collaborations with other universities, national and international cooperative groups, that are active in the biomedical research field;
- undertake relationships and collaborations with public and private entities with respect to its mandate;
- undertake and participate in initiatives for the dissemination of knowledge in the fields of pertinence for the purpose of cultural and professional training in both undergraduate and graduate education;
- promote and protect welfare behaviour in the fields of teaching and research in the Department.

## ERC MAIN RELEVANT PANELS

- **LS1 Molecules of Life: Biological Mechanisms, Structures and Functions**
- **LS2 Integrative Biology: from Genes and Genomes to Systems**
- **LS4 Physiology in Health, Disease and Ageing**
- **LS7 Prevention, Diagnosis and Treatment of Human Diseases**
- **PE6 Computer Science and Informatics** [PE6_11, PE6_13]
- **SH6 The Study of the Human Past** [SH6_14]

For above reasons, the DMSC likely represents a unique example in the Italian context, owing to the fact that the skills necessary to address different experimental and translational needs are all concurrently available, also with the skills to generate advanced diagnostic and therapeutic applications as well as offering new platforms and methodologies useful for translational research and clinical applications. The main features of the research is indeed a multidisciplinary approach to study metabolic, endocrine, cardiovascular, gastroenterological, rheumatologic, pneumological, neurological, oncologic, infectious and immunologic diseases. Such a multidisciplinarity is strengthened and further qualified by the involvement of researchers and clinicians in cooperation projects in clinical medicine contexts, in order to provide answers to any novel request coming from the scientific community. The DMSC hosts a wide range of Laboratories equipped with classic and innovative technologies. Synergies have been consolidated in defined areas of cooperation among research groups. The Department coordinates the PhD course in Clinical Sciences whose main goal is to promote application of biotechnology and molecular technologies in medicine. Within the Department 14 research units are active (https://www.dmsc.unifi.it/vp-32-centri-e-unita-di-ricerca.html). Of note, DMSC has been appointed as Department of Excellence by the Ministry of Research and University,  covering the five-year period 2018-2022.

# KEY RESEARCH ACTIVITIES

The main aim of DMSC is to integrate clinical and basic research with teaching of both undergraduates and post-graduates within the School of Medicine. Clinical and preclinical research lines are thus shared among the various units of the Department, which are routinely involved in diagnostic and therapeutic management of patients referred to the University Hospital of Florence.

The Department also has the following main research and teaching fields: surgery (oncology, abdominal transplants, geriatrics, endocrinology, urology, orthopaedics), anatomy and histology, infection diseases, Health Services Research, physiology,  geriatric medicine, nephrology, hepatology, endocrinology and metabolism, gastroenterology, cardiology, atherothrombotic disease, immunology, oncology and hematology, rheumatology, and nutrition.

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

The DMSC has many well equipped laboratories linked to the effervescent research activity at the university and Careggi University Hospital, also thanks to the Interdepartmental Centers and Research technological  Platforms that are fully operational; many of these have been upgraded or de-novo activated in the last three years and now organized in a Departmental Multi-Technological Platform: A) Functional Sequencing Platform, B) Functional Imaging Platform, C) Cytofluorimetry Platform, and D) Tissue Engineering and Opto-Mechanical Functional Analysis Platform.

Throughout the years the collection grew thank to include the acquisition of new departmental technologies (e.g. Bio-Plex200 system Biorad, QX200 Droplet Digital PCR system Biorad, cryostatic microtome Leica, Sanger Sequencer CE-IVD 3500DX Thermo Fisher, NextSeqTM 2000 Sequencing System Illumina, Affymetrix GeneChip Scanner 3000 7G system with fuidics station, spectral and conventional flowcytometer BD FACSymphony™ A5 SE 9Blue/6Red/14Violet/9YG/10UV, GridIon Nanopore e miseq illumine,  flowcytometer BDFACSLyricTM System 3L12C instrument CE-IVD con BDFACS Universal Loader, laser scanning confocal microscope TCS-SP5 Leica)) that was also made possible thanks to additional funding deriving from the Department of Excellence, summing up to €1,500,000. This effort has facilitated collaboration between researchers, and allowed strong research programs to be promoted by DMSC. The COMputational BIomediciNE Laboratory - COMBINE, is part of our department, with the objective to helping scientists make sense of complex multi-dimensional data. COMBINE Laboratory is involved in basic and advanced research in the field of computational methods and their application in biomedicine. It is deeply committed in the implementation and development of computational methods and strategies for analysis and management of complex bioinformatic data (genomics, transcriptomics, proteomics, epigenetics, metabolomics, phenomics, imaging) aimed at enhancing biomedical research and diagnostics.

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

DMSC has undertaken and has been funded in 7 Horizon 2020 projects, one under the Erasmus program and another founded from ERA-Net ERA-HDHL. During 2021 DMSC has been granted 58 national (i.e. from AIRC) and 5 international projects, most of which having members of the department as coordinator. In the same period DMSC obtained 10 regional funding and received 71 funding grants from third parties in the setting of investigational clinical studies or other forms of collaborations.
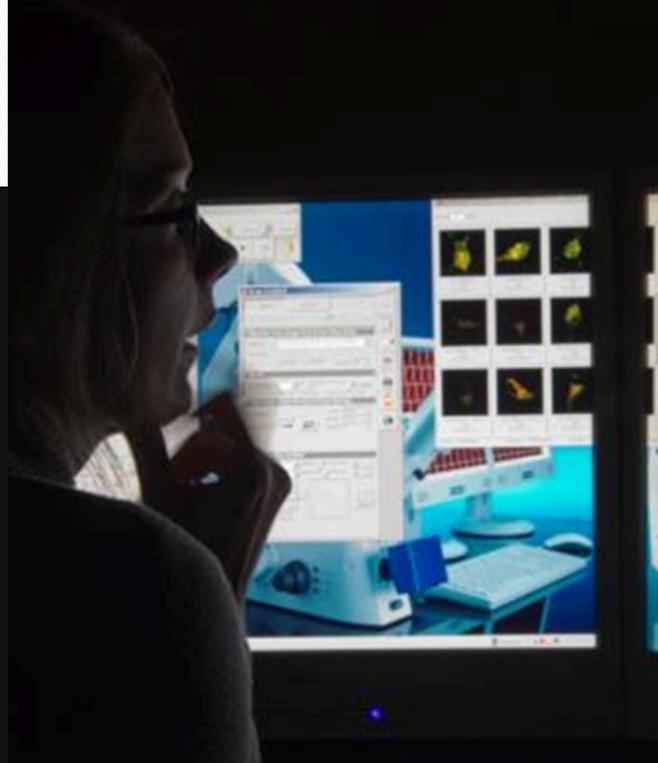
## CONTACTS

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# DEPARTMENT OF NEUROSCIENCES, PSYCHOLOGY, DRUG RESEARCH AND CHILD HEALTH

www.neurofarba.unifi.it

The Department is composed of the administrative and scientific merging of six sections: Neurosciences, Pharmaceutical and Nutraceutical, Pharmacology and Toxicology, Psychology, Child Health, and Sensory Organs. The daily interaction of different preclinical and clinical skills gives rise to translational biomedical research. The research activity carried out in NEUROFARBA promotes the study of diseases pathophysiology, the identification of new drug targets, the study of the composition and properties of foods, and the setting of diagnostic and therapeutic strategies. Finally, the study of psychological constructs and their plasticity contributes to individual health.

The Department meets an extensive network of national and international collaborations, among which research institutions, charitable organizations, and scientific societies, that also take shape in three research centers (Cera, CeSAL, CIRIM). NEUROFARBA is actively involved in Third Mission and Public Engagement as inferable from the Department Year Report and hosts public/private laboratories including Information Systems for pharmacology, pharmacovigilance and pharmacoepidemiology, Synthesis of peptides of pharmaceutical interest, NeuroGenetics in Rehabilitation and Perinatal Research. The department claims many collaborations with pharmaceutical companies to evolve knowledge produced by academic research into knowledge useful for productive purposes.

Researchers with a high scientific profile are enlisted in NEUROFARBA, among which is a gender balance with a woman/man ratio of 1.4 and important governance positions held by women. Recent results from the VQR3 exercise confirm the department's high qualification with top Hindex in the field of scientific research and a high-level scientific production. NEUROFARBA was classified as excellent by the Ministry of University and Research for the quality of research and scientific perspectives. It was funded with a dedicated grant to prompt research in the period 2023-2027 over the theme "New methodological strategies: challenges for the development of a personalized therapy for fragile patients".

## ERC MAIN RELEVANT PANELS

- **LS1 Molecules of Life: Biological Mechanisms, Structures and Functions**
- **LS3 Cell Biology, Development, Stem Cells and Regeneration**
- **LS5 Neuroscience and Disorders of the Nervous System**
- **LS9 Biotechnology and Biosystems Engineering**
- **PE5 Synthetic Chemistry and Materials** [PE5_18]

# KEY RESEARCH ACTIVITIES

### NEUROSCIENCES

- Preclinical and clinical, epidemiological, biological, genetic, biochemical, immunological and translational study of neurological and psychiatric disorders.
- Study of cerebrovascular diseases, cognitive processes and related disorders (e.g. dementia and Alzheimer's disease), neurogenetics, neuroimmunology, multiple sclerosis, neurorehabilitation, neuroimaging, rare neurological diseases, psychic disorders.

## PHARMACEUTICAL AND NUTRACEUTICAL SECTION

- Design in silico, synthesis, characterization, and optimization of compounds active toward biological targets such as enzymes, receptors and nucleic acids by using high throughput screening (HTS), fragment-based drug design (FBDD), structure-based drug design (SBDD), ligand-based drug design (LBDD). Development of models for prediction of ADMET properties.
- Design, synthesis and characterization of peptides of immunologic, pharmaceutical and cosmetic interest.
- Identification and quantification of bioactive metabolites in plant-based food, medicinal plants; development of extraction and analytical methods for metabolomic studies

## PSYCOLOGY

- Study of cognitive processes (perception, categorization, recognition, memory and imagination and false memories) in healthy and subjects with neuropsychological problems.
- Study of sleep and wakefulness as a function of age, and cognitive processes related to sleep.
- Study of human perceptual systems with attention to vision and neuronal mechanisms related to perception.
- Development, validation and adaptation of psychological, behavioral, and neuropsychological measurement instruments.
- Study of neural circuit plasticity in response to experience.

## PHARMACOLOGY AND TOXICOLOGY

- Neuropharmacology: histaminergic, dopaminergic, serotonergic, purinergic, adrenergic, cholinergic, gabaergic and glutamatergic modulation in cognitive processes and in anxiety disorders, depression, stress, food consumption, and in both inflammatory and neuropathic pain.
- Cardiopharmacology: identification of new drugs with antiarrhythmic activity, electrophysiological remodeling in both physiological and pathological conditions. Pharmacology of cardiovascular risk factors.
- Experimental and Clinical Toxicology: study of intestinal carcinogenesis using in vivo and in vitro models, chemoprevention, intestinal inflammation, and genotoxic damage.
- Pharmacology of inflammation and immunopharmacology: study of inflammatory and immuno-allergic pathologies of the central nervous system and peripheral organs such as the respiratory and ocular systems; study of compounds active on the histaminergic system, nitric oxide donors, carbonic anhydrase inhibitors and PARP.
- Pharmacovigilance, phytovigilance and pharmacoepidemiology: search for adverse drug reactions (ADR) using regional and national databases to identify signal alarms due to drug-related disorders; design and implementation of Pharmacoepidemiology studies.

## CHILD HEALTH

- Study of drug treatment and neuroprotection in hypoxic-ischemic brain injury and neonatal– infantile seizures.
- Study of fetal programming, pediatric rare diseases, perinatal bioethics, solid organ transplantation and pregnancy.
- Study of the intestinal microbiota and yeasts in inflammatory intestinal diseases
- Study of juvenile idiopathic arthritis, Kawasaki disease, uveitis, pediatric connective tissue disease and auto-inflammatory syndromes
- Study of hemodynamics, respiratory insufficiency, hyperbilirubinemia, oxidative stress in the newborn.
- Study of congenital diseases from immunological dysregulation and hereditary metabolic diseases
- Study of infantile cerebral palsy, movement disorders, neuromotor rehabilitation.

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

Dedicated centers for animal housing and preclinical imaging are available. Moreover, several instruments are currently running in the department:

- GC/MS – HPLC
- NMR spectrometer
- Microwave synthesizer
- Automated peptide synthesizer
- Plasmonic resonance optic biosensor
- Simoa for biomarker analysis
- Biosafety level 2 laboratory (BSL2) for the use of MOGM in vitro and in vivo
- PCR Real Time system (QuantStudio5- Applied Biosystems)
- Microplate reader (Victor- Nivo)
- Nanophotometer (Accuris instruments)
- Chemidoc imaging system for western blot analysis (Biorad)

- MEA- Multi Electrode Arrays (Axion Biosystems)
- Leica Thunder Imager 3D tissue
- Eyetracking system
- Software for behavioral analysis
- Vibratome
- Fluorescence microscope with spinning disk system (Nikon N-SIM TIE microscope (Nikon))
- Cell counter
- Organoid laboratory equipped with a Class II biosafety cabinet and $CO_2$ incubator
- Patch clamp system for electrophysiology analysis
- Imaging laboratory equipped with Fluorescence microscope with spinning disk system and integrated AI software (IXploreSpin-HIGH Content - EVIDENT OLYMPUS)
- Cryostat for tissue sectioning (Leica)

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

**FUNDER: EUROPEAN COMMISSION**
- **GenPercept** Spatio-temporal mechanisms of generative perception
- **REACH** Russian European Alliance for research among women, Children and adolescents impacted by HIV, TB and HCV
- **MeaTIc** Faecal microbiome as determinant of the effect of diet on colorectal-cancer risk: comparison of meat based versus pesco-vegetarian diets

**FUNDER: MINISTRY OF UNIVERSITY AND RESEARCH**
- **Bacterial carbonic anhydrase as drug targets: toward a new generation of antibiotics**
- **Temporal context in perception: serial dependence and rhythmic oscillations**
- **Deciphering the role of Carbonic Anhydrase isoforms in psychiatric disorders**
- **RHYTHM-INSIGHT** Unraveling hidden culprits for the cardiac arrhythmia burden: modulation of immunoinflammation and inter-cellular signaling as targets for novel therapeutic approaches
- **MISMatCH** Metabolic regulation of cortical visual processing in mice and humans
- **Characterization of the pathophysiology of three lysosomal storage diseases (Pompe disease, Morquio disease and GM1 gangliosidosis) and identification of novel therapeutic targets**
- **Development of prediction models for seizure and cognitive outcome after epilepsy surgery in children and adults**
- **Clinical, imaging and serological biomarkers to distinguish inflammatory demyelinating diseases: multidimensional diagnostic algorithm and long-term management**
- **The CIPS-TER Study** Cognitive Impairment Post Stroke: a single-blinded randomized trial on the efficacy of TEleRehabilitation
- **How does the brain deal with stimuli of opposite emotional content? Understanding the role of hypothalamic histaminergic neurons and their interplay with the basolateral amygdala and the auditory cortex in processing appetitive and aversive stimuli**
- **STAT3-related inborn errors of immunity: unraveling disease mechanisms and potential targets**
- **Psoriasis and sleep: an integrated clinical and cognitive approach**
- **Targeting microglia CB2 Receptors with novel multisite ligands: a multidisciplinary and translational study for the identification of an innovative multiple sclerosis therapy**
- **miRNA 137 as a mediator of adolescent alcohol drinking and comorbid disorders caused by prenatal alcohol exposure**

- **Harnessing the potential of the THP: moving toward the development of a clinical-grade kit for a peptide-based PET imaging agent for real-time imaging and treatment of aberrant c-Met cancers for another giant step in cancer treatment**
- **Multiomics and Machine Learning to predict response to drug therapies in pediatric Eosinophilic Esophagitis**
- **An integrated multimodal approach for an in vitro evaluation of the nutraceutical potential of botanical extracts (phytocomplexes) from Olea europaea L. and Punica granatum fruit**
- **Targeting the protein kinase CK1delta as a strategy to enlarge the therapeutic toolbox against Amyotrophic Lateral Sclerosis (ALS)**
- **OPTO-19F-LUIDICS** Fluorinated hybrid photopolymers for the fabrication of robust diagnostic optofluidic devices
- **MuTaG4L** Multi-targeting G-quadruplex ligands as innovative chemotherapeutic agents to combat tumor drug resistance
- **RIGHTSTRESS** Tuning arousal for optimal perception
- **PROMETHEUS** 4D printing self-deploying bio-enabled polymer scaffolds for the non-invasive treatment of bleeding intestinal ulcers

**CONTACTS**

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UNIVERSITÀ DEGLI STUDI FIRENZE | Dipartimento di Scienze Biomediche, Sperimentali e Cliniche "Mario Serio"

# DEPARTMENT OF EXPERIMENTAL AND CLINICAL BIOMEDICAL SCIENCES "MARIO SERIO"

www.sbsc.unifi.it

The Department of Experimental and Clinical Biomedical Sciences "Mario Serio" (DSBSC) is composed of 107 professors and researchers, belonging to 15 scientific disciplinary sectors across clinical and preclinical biomedical areas. Faculty members carry out teaching activities within the Schools of Human Health Sciences, Mathematical, Physical and Natural Sciences, Engineering, Psychology and Agriculture.

The Department hosts 12 Specialization Schools (9 medical and 3 non-medical), with over 330 residents, 6 First- and Second-Level Master Programs, and advanced professional training courses. It is the administrative seat of the PhD in Biomedical Sciences and participates in two inter-university doctoral programs (Biochemistry and Molecular Biology; Genetics, Oncology and Clinical Medicine – GenOMeC), hosting approximately 25 PhD students per cycle.

Over the past eight years, the Department has been awarded three ERC Grants (Starting, Consolidator and Advanced). Faculty members serve on European evaluation panels including ERC and Marie Skłodowska-Curie Actions.

The Department presides over 11 Clinical Units at AOU Careggi and AOU Meyer University Hospitals, as well as 4 Regional Coordination Centers and 3 European Reference Centers.
 In 2024, the Department was involved in 180 active profit clinical trials (31 newly activated) and 13 newly activated non-profit trials.

The Department has been awarded the national title of 'Department of Excellence' twice (2018–2022 and 2023–2027), confirming its leadership in biomedical research and innovation.

## ERC MAIN RELEVANT PANELS

- **LS1 Molecules of Life: Biological Mechanisms, Structures and Functions**
- **LS2 Integrative Biology: from Genes and Genomes to Systems**
- **LS3 Cell Biology, Development, Stem Cells and Regeneration**
- **LS4 Physiology in Health, Disease and Ageing**
- **LS7 Prevention, Diagnosis and Treatment of Human Diseases**
- **LS8 Environmental Biology, Ecology and Evolution**

## KEY RESEARCH ACTIVITIES

In 2024, the Department produced >400 peer-reviewed articles, with nearly half of the output being interdisciplinary. The Department consistently ranks among the top biomedical departments of the University of Florence for scientific productivity and competitive funding success.

- Biology of stem cells
- Single-cell transcriptomics and spatial multi-omics
- Gender medicine and sex-based biological differences
- Tumor metabolism
- Hepatocellular carcinoma
- Breast cancer and hormonal biomarkers
- Malignant melanoma
- Crohn's disease

- Pathogenesis of renal and inflammatory diseases
- Androgens and cardiovascular pathology
- Metabolic disease and male infertility
- Green models for compound delivery in cancer prevention
- Advanced diagnostic imaging and radiotherapy technologies
- Medical physics and applied biomedical technologies

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

The Department hosts a transversal Molecular Medicine and Single-Cell Facility supported by six specialized technical staff members, including bioinformatics expertise.

- High-resolution and confocal microscopy
- Single-cell RNA sequencing (Chromium iX platform)
- Spatial transcriptomics and multi-omics technologies
- Metabolomics
- Multiparametric flow cytometry and cell sorting
- Digital histopathology
- Nanoparticle analysis (Nanosight)

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

The Department demonstrates strong performance in competitive research funding at national and international levels.

- Over €3 million annually in competitive research grants
- 6 European projects, including 1 ERC Advanced Grant
- Multiple national grants (PRIN MUR, FIS MUR, AIRC)
- €2.6 million assigned through PNRR programs
- €9.3 million received under the Department of Excellence program
- Over €1 million annually in third-party research contracts

The Department maintains 8 active patents, 2 internationally awarded spin-offs, and 7 joint laboratories with industrial partners, contributing to technological transfer and regional economic development.

## CONTACTS

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# DEPARTMENT OF HEALTH SCIENCES

www.dss.unifi.it

The Department of Health Sciences builds and promotes a cooperative environment among researchers, aiming at reaching scientific achievements promoting knowledge on human health and disease therapy. These goals are achieved thanks to the active relationship among the members of the University and cooperation with students, patients and people, which are at the heart of the daily work of the Department. Research, teaching and health services are focused on the recognition and valorization of scientific merit.

## KEY RESEARCH ACTIVITIES

The Department of Health Sciences, since its foundation in 2013, is a well known research center focused on the health protection, which is defined in its broadest meaning, as "a full state of physical, psychical and social health, and not just as a disease free state". In doing so, the Department of Health Sciences builds its structural organization in a way to facilitate the interaction among the basic and clinical research, beyond the promotion of interdisciplinary cooperation. Research activities' management is broadly founded on principles such as clearness, rightness and the contributions valorization, mainly of the young researchers. Thanks to this strategy and approach, the Department of Health Sciences was able to establish a wide rage of cooperation with private and public partners, among which others prestigious universities both national and international such as those with the University of Siena, the Department of Public and Pediatric Health Sciences of the University of Turin, the Department of Health Sciences of the University of Genoa, University of Verona and the University of Ferrara, the Chulalongkorn University (Thailand), Osaka University (Japan), University of Montana (U.S.A.) and University of Belgrade (Serbia).

The Department of Health Sciences established since 2018-2020 cooperation agreements and joint ventures with the Careggi University-Hospital (Florence), Children University-Hospital Meyer (Florence), Sant'Andrea University-Hospital (Rome), ASL Toscana Centro (Tuscany), l'Azienda SOCIO SANITARIA TERRITORIALE DEGLI SPEDALI CIVILI DI BRESCIA (Brescia, Lombardy), ARS Toscana (Tuscany), ISPRO (Institute for the oncological study and prevention), Ministry of Health, ISS (Istituto Superiore di Sanità), INAIL and the civil protection, promoting altogether excellence programs.

Among the private partners, there are ongoing joint ventures with companies such as AstraZeneca Spa, Pfizer, Chiesi farmaceutici, Sanofi, NOVARTIS FARMA SPA, Aboca SpA, ACRAF ANGELINI SpA, Baxter Healthcare Corporation and GlaxoSmithKline SpA. Moreover, we annoverate many other cooperation dealing in working progress with the

## ERC MAIN RELEVANT PANELS

- **LS1 Molecules of Life: Biological Mechanisms, Structures and Functions** [LS1_13]
- **LS2 Integrative Biology: from Genes and Genomes to Systems** [LS2_14, LS2_15]
- **LS3 Cell Biology, Development, Stem Cells and Regeneration** [LS3_1]
- **LS4 Physiology in Health, Disease and Ageing** [LS4_12]
- **LS5 Neuroscience and Disorders of the Nervous System** [LS5_1, LS5_2, LS5_7, LS5_9, LS5_11, LS5_12]
- **LS6 Immunity, Infection and Immunotherapy** [LS6_4, LS6_10]
- **LS7 Prevention, Diagnosis and Treatment of Human Diseases** [LS7_2, LS7_7, LS7_9]
- **SH4 The Human Mind and Its Complexity** [SH4_3, SH4_4]

Children-Hospital Foundation Anna Meyer onlus, Italian Technological Institute Foundation, Emilio Trabucchi Foundation, Brain Research Foundation Onlus, CNR/Tuscany Region for the clinical and public health research-Gabriele Monasterio Foundation, Consorzio Futuro in Ricerca (CFR), Italian Society of Pathological Anatomy and Diagnostic Cytopathology, Institute of Pharmacological Research Mario Negri Foundation IRCCS, ORSA Study Center, Florence CR Bank, International Economic Study Center (C.E.I.S.) of the University of Rome Tor Vergata (Rome), Center of Neurology Psychiatry and Clinical Psychology SRL, Servier Research Institute Srl, Cooperative Society a.r.l., "Alas Psychological Sciences Center" and Florentine Institute of Care and Assistance – Casa di Cura Ulivella e Glicini IFCA.

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

- Development of innovative pharmacological approaches for the treatment of pain, autoimmune and brain ischemic disorders
- Epidemiology, biostatistic and public health
- Placental pathophysiology and microbiota
- Autologus and heterologus mammary surgical reconstruction. Surgery and microsurgery reconstruction techniques. Facial reinnervation techniques. Dermal matrix and adipose stem cell
- Morphological and molecular characterization of melanoma, mammary carcinoma, urological and hematopoietic malignancies
- Etiopathogenesis and psychopathology of mental disorders
- Medico-legal litigation; forensic pathology, toxicology, psychopathology and odontology; identification of livings and dead bodies.
- Skin tumor immunopathogenesis, Clinical immunodermatology, Molecular targets of inflammatory dermatosis.
- Electroencephalography for anaesthesia and sedation depth monitoring in the operating room and critical care. Continuous Renal Replacement Therapies in Intensive Care Unit
- Musculoskeletal disorders and orthopedic techniques. Prothesis and biomaterials.

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

**Exploitation of the NAD rescue pathway as a toxification route of relevance to cancer therapy**, PI Prof. Alberto Chiarugi, A.I.R.C. Investigator Grant - IG 2017, € 397,000.

**Epigenetic modelling/remodelling of cancer metastases and tumor immune contexture to improve efficacy of immunotherapy**, PI Prof. Daniela Massi, A.I.R.C. Bando 5 per Mille 2018, € 2,284,610

**Exploitation of the NAD rescue pathway as a toxification route of relevance to cancer therapy**, PI Prof. Romina Nassini, A.I.R.C. Investigator Grant - IG 2020, € 640,000

**SCOPE Schwann Cell Options for chronic Pain Eradication**, PI Pierangelo Geppetti, ERC 2019-2024, € 2,185,921.00.

**ETUDE Encompassing Training in fUnctional Disorders across Europe**, PI Prof. Fiammetta Cosci, Horizon Europe € 261,499.68

**MELCAYA Novel health care strategies for melanoma children, adolescents and young adults**, PI Prof. Daniela Massi, Horizon Europe, € 669.340,00

## CONTACTS

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# DEPARTMENT OF BIOLOGY

www.bio.unifi.it

The Department of Biology includes laboratories and research groups which work on a wide range of biological disciplines, spanning from microbiology, genetics, physiology, botany in all its aspects, zoology with a particular contribution from ethology, systematics, ecology of both aquatic and terrestrial environments, anthropology, cytology and histology, comparative anatomy and, as a common thread, the history of biology and natural sciences with evolutionary studies. The Department is strongly oriented towards basic research, but considers applications with attention and increasing importance, responding to current needs for innovation and development. Starting from the strong interest in basic scientific research and its applications, the teaching and technical staff of the Department is able to manage a good part of the teaching of the basic and applied biological and naturalistic disciplines of various educational paths: biology, natural sciences, conservation and invasion biology, ethology, biotechnologies, at the level of bachelor's, master's and doctoral degree courses. The rich and articulated history of the Department of Biology still emerges today in the structures in which its various components are located, which interact effectively with each other. On the one hand, the historic buildings in the center of Florence, in via La Pira, in via del Proconsolo and in via Romana, which are also home to the Museum of Natural History, represent the link with the more strictly naturalistic disciplines, while the offices at the Polo scientific center of Sesto Fiorentino welcome in particular the physiological, zoological and molecular disciplines.

## KEY RESEARCH ACTIVITIES

The Department is involved in projects involving ancient DNA and anthropological science, botany, zoology, ecology and nature conservation, plant and microbial genetics, microbiome studies, microscopy and biophysics and physiological studies at the molecular level.
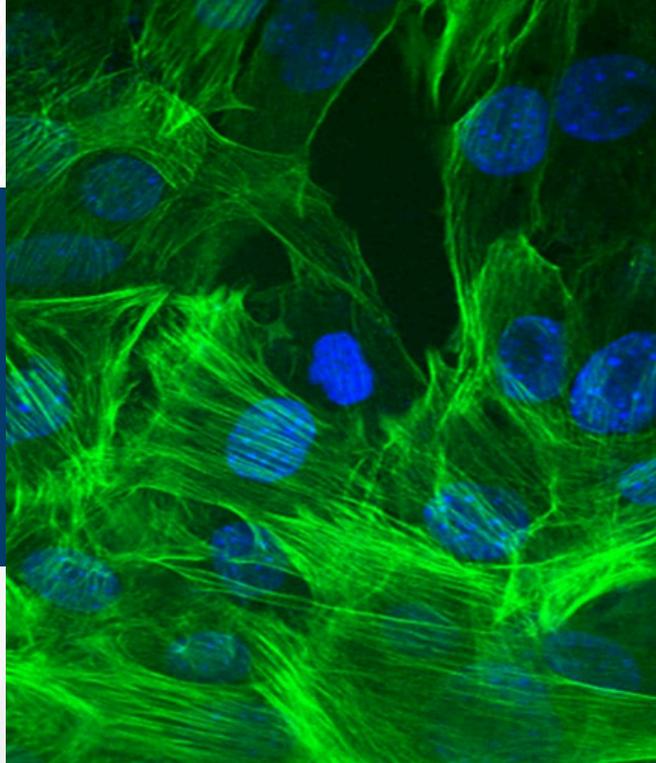
## ERC MAIN RELEVANT PANELS

- **LS1 Molecules of Life: Biological Mechanisms, Structures and Functions** [LS1_3, LS1_7 , LS1_10, LS1_14]
- **LS2 Integrative Biology: from Genes and Genomes to Systems** [LS2_1, LS2_2, LS2_3, LS2_4, LS2_5, LS2_6, LS2_7, LS2_8, LS2_9, LS2_11, LS2_12, LS2_13, LS2_14, LS2_15, LS2_16]
- **LS3 Cell Biology, Development, Stem Cells and Regeneration** [LS3_1, LS3_7, LS3_8, LS3_9, LS3_10, LS3_14, LS3_15, LS3_16]
- **LS5 Neuroscience and Disorders of the Nervous System** [LS5_1, LS5_2, LS5_3, LS5_5, LS5_7, LS5_8, LS5_9]
- **LS8 Environmental Biology, Ecology and Evolution** [LS8_2, LS8_3, LS8_4, LS8_5, LS8_6, LS8_7, LS8_8, LS8_9, LS8_10, LS8_11, LS8_12, LS8_13, LS8_14, LS8_15]
- **LS9 Biotechnology and Biosystems Engineering** [LS9_2, LS9_4, LS9_6, LS9_7, LS9_8, LS9_12]

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

The Department hosts one of the the largest facility for genetics and genomics present in Italy, including two short reads sequencers (Illumina NovaSeq6000, Illumina MiSeq), one long-read sequencer (Pacific Biosciences Sequel IIe) and a complete set of up-to-date instrumentation for library preparation. Electron and light microscopes with micromanipulator for chromosome dissection are present as well and facilities for in vitro plant cultures, laser-beam optical trapping and for ancient DNA manipulation.

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

Ongoing research European projects include partnerships in Horizon Europe FishEUTrust, TetRRIS BGE, GuardIAS, Life URCA PROEMYS, TETIDE, interreg ALIEM, MSCA SE BUILDERS, and coordination of the PRIMA project LEGU-MED and COST action EPI-CATCH. Among the national research projects the Department is coordinator and partners in several PRIN projects and other national grant programs from various Ministries and charity foundations.

## CONTACTS

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# DEPARTMENT OF CHEMISTRY "UGO SCHIFF"

www.chim.unifi.it

The Department of Chemistry "Ugo Schiff" (DICUS) is internationally recognized as one of Italy's leading centers for chemical sciences. DICUS ranked first nationwide in Chemistry in the Italian Departments of Excellence programme 2018–2022 and achieved a joint first position again in the 2023–2027 evaluation.

DICUS is located at the Scientific Campus of Sesto Fiorentino, occupying approximately 20,000 m² across two adjacent buildings. The Campus hosts a highly integrated research ecosystem that includes major departments in physics, biology, neuroscience, and agricultural sciences, as well as internationally recognized research infrastructures such as the European Lab for Non-Linear Spectroscopy (LENS), the European Center for Magnetic Resonance (CERM), the National Research Council (CNR), the National Metrology Institute (INRiM), the National Institute for Nuclear Physics (INFN) and the UNIFI Research Incubator (CsaVRI), fostering strong multidisciplinary collaboration.

The Campus is located a few kilometres from Florence and close to the airport. It offers sports facilities, including a swimming pool, tennis and volleyball courts, as well as student canteens at reduced prices. Students have access to fully equipped classrooms, computer workstations, campus-wide Wi-Fi, and the Animal Biology, Chemistry and Physics Library (part of the UNIFI Sciences Library). Public transport connections to the city centre are available.

DICUS comprises 116 researchers and 48 technicians/administrative staff with an excellent gender balance across all roles and seniority levels.

DICUS is the reference Department for three 3-year Bachelor degree programmes (BS in Chemistry, BS in Diagnostics and Materials for Conservation and Restoration and, since the aa 2023-24 also BS in Materials Science), one Single Cycle Master Degree in Chemistry and Pharmaceutical Technologies and four Master Degrees: one in Chemical Sciences, one in Sciences and Materials for Conservation and Restoration, one in Molecular Biotechnologies, and one in Advanced Molecular Sciences fully in English – with a total of 1460 regularly enrolled students in the a.a. 2024/25. In addition, DICUS is responsible for two PhD Programmes: Chemical Sciences and Structural Biology hosting every year more than 100 PhD students in a research intensive and international environment.

## ERC MAIN RELEVANT PANELS

- **PE3 Condensed Matter Physics** [PE3_4, PE3_7 , PE3_8  PE3_9, PE3_11, PE3_13]
- **PE4 Physical and Analytical Chemical Sciences** [PE4_1, PE4_2, PE4_3, PE4_4, PE4_5, PE4_8, PE4_10, PE4_13, PE4_18]
- **PE5 Synthetic Chemistry and Materials** [PE5_3, PE5_6, PE5_8, PE5_9, PE5_10, PE5_11, PE5_12, PE5_13, PE5_15, PE5_16, PE5_17, PE5_18]
- **PE8 Products and Processes Engineering** [PE8_11]
- **PE10 Earth System Science** [PE10_1, PE10_3, PE10_6]
- **PE11 Materials Engineering** [PE11_1, PE11_4, PE11_9, PE11_10]
- **LS1 Molecules of Life: Biological Mechanisms, Structures and Functions** [LS1_1, LS1_2, LS1_7, LS1_8, LS1_13]
- **LS2 Integrative Biology: from Genes and Genomes to Systems** [LS2_8, LS2_9]
- **LS4 Physiology in Health, Disease and Ageing** [LS4_9, LS4_12]
- **LS5 Neuroscience and Disorders of the Nervous System** [LS5_11]
- **LS7 Prevention, Diagnosis and Treatment of Human Diseases** [LS7_2, LS7_3, LS7_10, LS7_12]
- **LS9 Biotechnology and Biosystems Engineering** [LS9_11, LS9_12]

DICUS hosts the headquarters of three inter-university research consortia: the CIRMMP, dedicated to Magnetic Resonances of Metal Proteins (https://www.cerm.unifi.it/about-us/cirmmp), the Center for Colloid and Surface Science CSGI (http://www.csgi.unifi.it/) and the National Institute for Materials Science and Technology INSTM (http://www.instm.it/). In addition, DICUS is involved in three Centers of Competence of UNIFI (CERM TT, RISE and VALORE), funded by the Tuscany Region, for business innovation and technology transfer.

In the period 2018-25 DICUS participated in research projects funded on a competitive basis for more than 51 M€ (international, national and regional projects). Many collaborations with industrial partners are also constantly ongoing.

In terms of scientific production, during the period 2018-25, more than 3000 articles have been published by DICUS researchers in international peer reviewed scientific journals. These articles are characterized by a strong interdisciplinarity and a high content of innovation. DICUS has also been able to put its skills at the service of research activities in the field of COVID-19, by participating in several projects funded on this topic and numerous publications.

Concerning the activities related to knowledge valorisation and transfer, the impact of DICUS research activities on the productive value chain is demonstrated by the contribution to technology transfer, as well as the ability to patent the scientific results (ten patents in the 2018-25 period).

# KEY RESEARCH ACTIVITIES

DICUS has well established excellences in the field of chemistry for the environment and life sciences, structural and biological chemistry, molecular magnetism, photovoltaics and molecular quantum computing, molecular spectroscopy, synthetic and formulation chemistry, smart drug delivery systems, and modeling of complex systems, peptide and glycan chemistry, structure and dynamics of high pressure molecular systems, classical and ab initio molecular dynamics simulations, electrochemistry, sensors and biosensors, food chemistry, separation sciences and advanced materials for biomedical applications and for the preservation and restoration of the historical and artistic heritage.

In addition, the recent recruitment of internationally recognized experts and the acquisition of state-of-the-art equipment have allowed the development of new research lines based on the understanding of molecular, nanometric and micrometric phenomena, with an increased interest in issues related to green chemistry and sustainability, recycling and re-use of waste materials and biomass, clean energies, including hydrogen production and fuel cells, good health and well-being, climate action and environment including microplastics, bioremediation and pollution monitoring and control.

The DICUS personnel operates also in international large-scale facilities (Synchrotrons, Neutron Sources, Muon sources) as well as in national and international institutions (EMBL, Artic and Antarctic Italian bases).

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT



The excellence of DICUS research in the field of chemical sciences is ensured by the availability of state-of-the-art equipment for structural, spectroscopic, analytical and functional studies, as well as the ability to design and produce new molecules and innovative materials.

Part of the DICUS staff is affiliated with major research centers and infrastructures, including **CERM** (European Centre for Magnetic Resonance; Italian headquarters of the INSTRUCT structural biology ERIC infrastructure), **CRIST** (University Service Centre for Structural Crystallography), **LAMM** (Laboratory for Molecular Magnetism), **LENS** (European Laboratory for Non Linear Spectroscopy), **CETECS** (Center for Scanning Probe Technologies), **CIRIB** (Interdepartmental Research Center on Biomedical Imaging) and **CSGI** (Center for Colloid and Surface Science), which are reference centers for nuclear magnetic resonance, X-ray diffraction, magnetism, photonics and surface science, molecular diagnostics, and physical chemistry respectively.

DICUS can also rely on a **high-pressure laboratory (LAP)** with safety standards for reactions in extreme conditions.
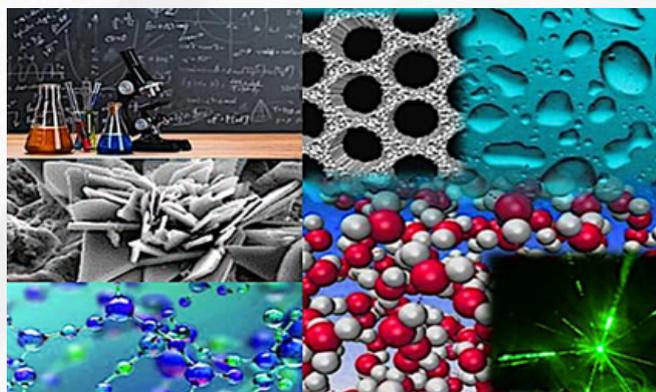
Among the advanced instrumentation present in the Department, several **cutting-edge instruments** have been recently acquired, including, but not limited to:

- a state-of-the-art cryo-electron microscope (**cryo-EM**) in its **FloCEN Lab** (Florence Center for Electron Nanoscopy)
- Xenocs Xeuss 3.0 HR **small and wide-angle X-ray scattering system**: SAXS (Small Angle X-ray scattering), USAXS (Ultra SAXS), WAXS (Wide Angle X-ray scattering) and GISAXS (Grazing Incidence SAXS)
- HORIBA FluoroMax Plus **Spectrofluorimeter**
- Field emission Scanning Electron Microscope **(SEM)** FEG-SEM Sigma Zeiss
- **Gasporosimeter** 3FLEX Micromeritics
- **Raman confocal microscope** InVia Qontor Renishaw
- **Confocal microscope** Leica TCS SP8 with DMI8 microscope and FCS Picoquant module and microfluidics basic equipment
- **Zetasizer** Malvern PRO Red Label for light scattering and Z potential
- Quartz Crystal Microbalance with Dissipation (**QCM-D**) Analyzer (QCMicrobalance-Biolin)
- Universal Testing Machine (**UTM**-Instron-6800)
- **Micro compounder** (Xplore MC5)
- **Vibrating Mill** (Retsch MM500)
- **Super-Resolution Confocal Microscope** (Nikon AX-R NSPARC)
- **High Content Screening (HCS)** ImageXpress System
- Cell Culture Lab (**BioSafetyLevel2**)

Furthermore, DICUS is equipped with several NMR machines, GC/MS, direct inlet MS, ESI/MS, IR, HPLC, GPC-SEC, microwave reactors, ICP-AES, capillary electrophoresis, CHNS/O analysis, differential scanning calorimetry, , atomic force microscopes, and other standard instruments.
A list of equipment can be found at https://www.chim.unifi.it/p363.html
DICUS has also recently promoted the establishment of a High-Performance Computing Center (**HPC@UNIFI**) in the Campus.
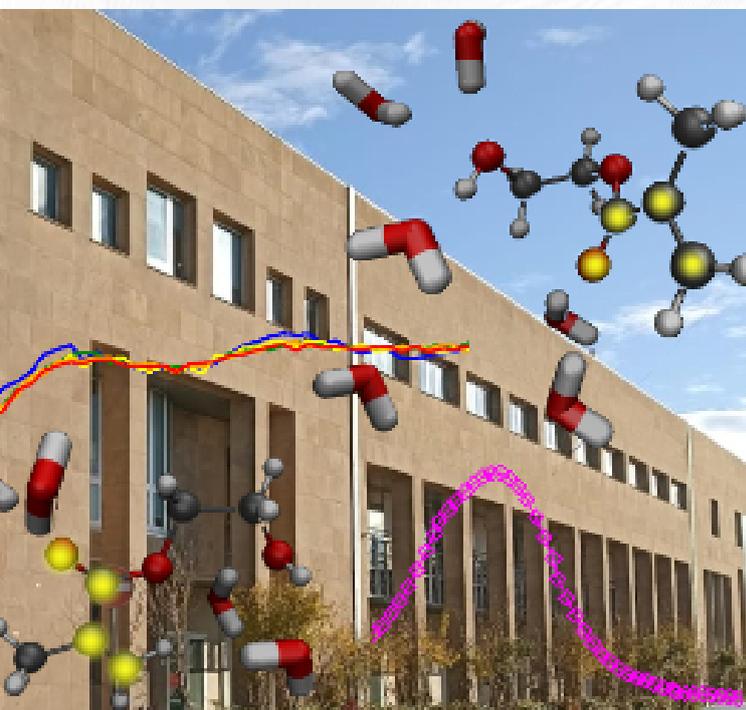


In the frame of the **Department of Excellence 2023-2027** project, three state-of-the-art technological platforms are being installed in DICUS premises:

1. **Green, Sustainable Chemistry and Scale Up Lab**, which includes reactors for innovative sustainable synthesis techniques and for scale-up. This new laboratory contributes to the reduction of the environmental impact of synthetic processes (from materials to pharmaceuticals) with clear compliance with the DNSH principles;
2. **Materials, Processing, Characterization and Molecular Interactions Lab**, which includes new instrumentation for the manufacture and manipulation of microfluidic devices, for the morphological and mechanical characterization of materials and surfaces and the study of the interaction between innovative (bio)materials and (bio)molecular targets at the solid-liquid and solid-gas interface;
3. **High-content Screening Lab**, which includes a state-of-the-art automated system for high-content screening of drug candidates in cells and organoids.

Three **infrastructures** have been recently created to integrate, in a synergistic way, the instrumentation available at DICUS and strengthen UNIFI competitiveness:

1. **Sustainable Materials Synthesis, Processing and Characterization Lab** (SMaSPC)
2. **Biointerfaces Characterization Center** (BiCC)
3. **High Resolution Imaging Lab** (HRIL)

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

DICUS conducts both **basic and applied research** with strong impact in strategic sectors, as reflected by numerous high-quality national (PRIN, ministerial projects, AIRC) and international (Horizon Europe, H2020, including ERC and FET) grants. Between 2018 and 2025, it secured **over €51 million in competitively funded projects**.

DICUS is involved in several projects related to the "**PNRR**" (National Recovery and Resilience Plan) that is part of the Next Generation EU programme, including the Tuscany Health Ecosystem-**THE**; 3 "National Centers": **CN1** - HPC, Big Data and Quantum Computing, **CN2** - Agricultural Technologies-Agritech, and **CN3** - Gene Therapy and Drugs based on RNA Technology; 5 "Extended Partnerships": **PE3** on Environmental, natural and anthropic risks, **PE4** on Quantum science and technology, **PE5** on Humanistic culture and cultural heritage, **PE8** on Ageing, **PE11** on circular and sustainable Made in Italy, and **PE12** on neurosciences and neuropharmacology. In addition, some DICUS members are participating to the project "Research Infrastructures" in the area ESFRI Health and Food-**ITACA**.

Between 2018 and 2025, DICUS has been involved in numerous **EC-funded projects** with a total budget of approximately **€13.5 million**. These include **five ERC** grants spanning molecular magnetism, molecular spintronics, quantum computing, and cultural heritage conservation; one project related to the **Mission Oceans, Seas and Waters** addressing innovative solutions for Mediterranean ecosystem remediation; **two MSCA-Postdoctoral Fellowships**; and **eight MSCA-Doctoral Networks**, five of which are coordinated by DICUS ("GlycoNoVi", "FC-RELAX", "GlyCanDrug", "ENSCC", and "CanGoNano").
DICUS also participates in **two FET** (Future and Emerging Technologies) projects, **two Research Infrastructures** in digital and structural biology, **one BBI-JTI** (Bio-based Industries Joint Technology Initiative), and **four MSCA-Research and Innovation Staff Exchange** projects. DICUS has been grant holder of the COST action INNOGLY. DICUS participates also in the **LIFE** project "MILCH".

Regarding **National Funding Programmes**, during 2018-2025 DICUS secured funding for **50 PRIN** (research projects of relevant national interest), with a total budget exceeding **€16.5 million**, funded by the Italian Ministry of University and Research (MUR). These include 27 PRIN 2022 (11 as coordinator) and 9 PRIN 2022 PNRR (3 as coordinator). DICUS is also involved in **more than 35 projects funded by different national programmes** (including those of the Ministries of Foreign Affairs, Health, Economic Development, Environment, Agricultural, Food and Forestry Policies, among others). Notably, DICUS coordinates **three AIRC**-funded projects on cancer research with a total budget of approximatively **€1.2million**.
In 2025, three DICUS projects were granted by the Italian Science Fund (**FIS**): one Advanced Grant and two Starting Grants. Together with the three previously awarded FIS grants, these amount to a to a total funding of approximately **€7.8 million**.

In addition, DICUS participates in **17 regional programmes**, mainly supported by FESR schemes, with a total budget of approximatively **€2 million**.

Furthermore, DICUS leads **over 60 projects funded by private entities and foundations** (Fondazione Cassa di Risparmio di Firenze, Istituto San Paolo, Telethon, Fondazione Cassa di Risparmio di Pistoia e Pescia, Banca d'Italia, etc.).
DICUS is also active in contract research **projects commissioned by external users**, generating approximately **€3 million** in revenue over the past eight years.

## CONTACTS

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# DEPARTMENT OF PHYSICS AND ASTRONOMY

www.fisica.unifi.it

The research activity at the Department of Physics and Astronomy covers all the main areas of theoretical and experimental physics, among these: physics of matter, optics and photonics, quantum physics, nuclear physics, high-energy physics, biophysics, physics of fundamental interactions, physics of complex systems, astrophysics and space science.

The Department is run by 90 Faculty members, working both in the headquarters in the University Campus of Sesto Fiorentino and in the former historical site in Arcetri (Firenze), and coordinates advanced high-education programs:

- 3 B.Sc Programs (Physics and Astronomy, Optics and Optometry, Materials Science);
- 2 M.Sc Programs (Physical and Astrophysical Sciences, Data Science, Scientific Computing & Artificial Intelligence);
- 2 PhD Programs (Physics and Astronomy, LENS International Doctorate in Atomic and Molecular Photonics).

Strong collaboration and synergies with important research institutes in the Florence area (among these: LENS, CNR-INO, CNR-IFAC, CNR-ISC, INFN-Florence, and INAF-Osservatorio Astrofisico di Arcetri) make the Department a crucial hub for all physics-related research activities in the Florence area (about 600 practitioners qualified to access the facilities) and the center of an extremely vital, unique framework for research and advanced education.

## ERC MAIN RELEVANT PANELS

- **PE2 Fundamental Constituents of Matter**
- **PE3 Condensed Matter Physics**
- **PE6 Computer Science and Informatics**
- **PE7 Systems and Communication Engineering**
- **PE9 Universe Sciencest**

# KEY RESEARCH ACTIVITIES

The research activity, both theoretical and experimental, spans from fundamental physical research to multidisciplinary applications, i.e. in medicine, biology, neuroscience, information science, cultural heritage, earth science, atmosphere science. More in detail:

Theoretical Physics: teory of fundamental interactions, relativistic and nuclear matter, holographic methods, high-energy astrophysics, dark matter and dark energy, black holes and gravitational waves; statistical mechanics, complex systems, artificial intelligence and machine learning, modeling of multidisciplinary phenomena (biology, chemistry, neuroscience); quantum information theory, many-body quantum physics.

Physics of Matter: optics, photonics, spectroscopy, advanced microscopy, biophotonics, atomic physics, ultracold atoms, quantum technologies, quantum optics, quantum communications, optomechanics, smart materials, complex optical systems, nanostructures, semiconductors, molecular magnets, soft matter.

High-Energy Physics and Nuclear Physics: design and development of instrumentation and detectors for accelerators and space-based experiments, data analysis methods for particle physics, study of astroparticles and cosmic rays, detectors for gravitational waves, search for dark matter; study of nuclear structure with high-energy ions, development of nuclear-physics techniques for environment and cultural heritage.

Astrophysics: observational studies of astrophysical objects, quasars, black holes, early stars and galaxies, exoplanets, solar physics; design of instrumentation for space missions, development of advanced optical and infrared equipment for ground telescopes; theoretical astrophysics, numerical methods for plasma physics, simulations of galaxy formation.

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

Advanced electronic workshop for prototyping and custom solutions
Advanced mechanical workshop for design and realization of custom jobs
Advanced laser equipment
Instrumentation for characterization of light sources
Single-photon sources and detectors
Spectrometers
Laser-cooling facilities
Ultra-high vacuum technology
Clean Rooms
Microscopy setups
Clean room with wire bonding facility and probe station for solid state detector R&D
Climatic chambers for prototype validation
3D printing facilities
LABEC: proton and nuclei source and accelerator (Tandem 6MeV) for cultural heritage applications, pollution monitoring, and detector testing and characterisation.
Astronomical telescope with imaging and spectroscopic instrumentation at the Osservatorio Polifunzionale del Chianti.

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

The research budget of the Department for the period 2017-2022 was about 17 million euros.

Most important funding agencies and bodies: European Commission (EC), Ministry of University and Research (MUR), Ministry of Enterprises and Made In Italy (MIMIT), Ministry of Health (MDS), Istituto Superiore di Sanità (ISS), Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), National Research Council (CNR), European Space Agency (ESA), Tuscany Region, Tuscan Cancer Institute, Azienda Ospedaliera Universitaria Careggi, Fondazione Cassa di Risparmio di Firenze (CRF), Fondazione AIRC per la Ricerca sul Cancro (AIRC) and many private technology industries (among these: Nuovo Pignone, Leonardo, El.En., Sony). European funding includes numerous ERC projects: 4 Advanced grants, 2 Consolidator grants, 4 Starting grants, 1 Proof of Concept grant (in ERC areas PE2 and PE9 the Department hosts the largest number of ERC winners among all Italian universities). Other European projects: 9 FP7, 1 LIFE, 3 H2020, 4 Marie Sklodowska-Curie Fellowships, 2 ERDF, 2 Horizon Europe, 1 EU RFCS.

National projects: 25 Research Projects of National Relevance (PRIN), 8 FIRB Futuro in RIcerca, 2 FARE, 4 Italian Space Agency (ASI), 31 Fondazione Cassa di Risparmio di Firenze (CRF), 2 BRIC projects National Institute for Insurance against Accidents at Work, 1 Bank of Italy, 1 Tuscany Region, 1 Human Frontier Science Program, 4 Rita Levi Montalcini contracts, 1 "Rientro dei cervelli" contract.

Research initiatives of the Mission 4.2 of the PNRR (NextGeneration EU/Recovery Plan), 2 National Centers for Research and Innovation, 4 Extended Partnerships, 1 Regional ecosystem for Innovation, 5 Research Infrastructures.

## CONTACTS

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# DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE "ULISSE DINI"

www.dimai.unifi.it

The Department comprises a faculty of approximately 80 professors and assistant professors. The academic community is further enriched by a cohort of 10 to 20 post-doctoral researchers and around 40 PhD candidates.

The Department's research activity spans the core areas of mathematics and computer science, including Algebra, Analysis, Computer Science, Geometry, Mathematical Physics, and Numerical Analysis. It serves as a hub for prestigious institutions and initiatives, such as the CIME Foundation (International Mathematics Summer School) and the editorial board of the journal Annali di Matematica Pura e Applicata.

Engaged in numerous research projects, the Department receives funding from the European Union as well as various national and international bodies. Key funding sources include the Italian Ministry for Universities and Research (MUR), the Istituto Nazionale di Alta Matematica (INdAM), and the National Research Council (CNR), with co-financing from the Istituto Nazionale di Geofisica e Vulcanologia, among others. Faculty members frequently serve as Principal Investigators for these initiatives.

Additionally, the Department coordinates a joint PhD program in Mathematics, Computer Science, and Statistics. It maintains a vibrant academic calendar, hosting research meetings, workshops, regular seminar series, and a Colloquium.

## ERC MAIN RELEVANT PANELS

- **PE1 Mathematics** [PE1_1, PE1_2, PE1_3, PE1_4, PE1_7, PE1_8, PE1_10, PE1_11, PE1_12, PE1_13, PE1_16, PE1_17, PE1_18, PE1_19, PE1_20, PE1_21, PE1_22]

## KEY RESEARCH ACTIVITIES

The Department's research activity spans the broad spectrum of mathematics and computer science. A selection of the primary specific interests is provided below:

- **Algebra**: Group theory; Representation theory; Character theory; Graph theory; Applications of group theory to Social and Voting theory.
- **Complementary mathematics**: History of mathematics, Mathematics Education.
- **Computer Science**: Complex network analysis and algorithms for large graphs; Computer science education; Discrete tomography and graph theory; Enumerative and algebraic combinatorics; Formal languages and code theory; Neural network applications in neurobiology; Random and exhaustive generation algorithms for discrete structures; System design, validation and assessment.
- **Geometry**: Algebraic geometry, Derived geometry, Complex and hypercomplex analysis, Geometric theory of holomorphic functions. Complex, Symplectic, and Differential geometry, Riemannian and pseudo-Riemannian geometry, Riemannian manifolds with prescribed sectional curvature, Combinatorics, Weighted graphs, Linear and multilinear algebra, Matrix completion, Foundations, didactic, popularization in Geometry.

- **Mathematical Analysis**: Calculus of Variations, Mathematical Control Theory, Partial differential equations, ODE's and Dynamical Systems.
- **Mathematical Logic**: Model Theory (Valuation theory, o-minimality and generalizations, Surreal numbers, differential algebra, Interactions with algebra). Logic for Computer Science (Computer formalization and theorem proving, Mathematics for abstract syntax and semantics, Univalent Foundation of Mathematics).
- **Mathematical Physics**: Quantum transport, applied quantum mechanics, nonlinear optics. Fluid dynamics, free-boundary problems and industrial mathematics.
- **General relativity and field theory**. Non-olonomous classical mechanics, coupled oscillations in mechanics and acoustics .
- **Numerical Analysis**: Numerical methods for differential problems (Geometric Integration, Energy-Preserving Methods, Isogeometric Analysis), Numerical approximation (Computer Aided Geometric Design, Geometric Modelling, Spline Functions: Theory and Applications, Spectrally Accurate Methods).
- **Probability and statistics**: Probability theory and statistical mechanics, Random Graphs and Complex Networks, Random walks, Markov processes, Queueing Theory.

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

The Department features a specialized library with an extensive collection of textbooks, monographs, journals, and digital resources. Facilities also include dedicated seminar rooms for academic exchange and a modern computer science laboratory.

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

Faculty members maintain a strong presence in competitive research funding. Regarding European frameworks like Horizon 2020, the Department has recently hosted at least two local coordinators. At the national level, participation is significant: between five and ten members have served as Principal Investigators or local leads for PRIN projects, while GNAMPA and GNSAGA projects (funded by INdAM) have seen similar numbers of coordinators over the last five years. Additionally, members have been involved in at least three strategic programs funded by the University of Florence.

The Department's portfolio is further enriched by participation in two non-EU European programs, three applied research projects co-financed by private partners, and a long-term national initiative funded by the Ministry of Culture.

## CONTACTS

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# DEPARTMENT OF EARTH SCIENCES

www.dst.unifi.it

The Department of Earth Sciences (DST) has been declared an Excellent centre to do research for two consecutive five-year periods (2018-2022 and 2023-2027) as the result of a national competitive call. Research covers a wide spectrum of disciplines with each one charaterised by innovation, technology, sustainability and modeling by using high performance calculus. The aim is to understand the processes that governs the evolution and the dynamics of the Earth system at different spatial and temporall scales, the impact and mitigation of natural hazards, resource sustainability, biogeochemical cycles, past and present biodiversity evolution, climate changes, and properties of terrestrial and extraterrestrial materials. Multidisciplinarity is the challenge required to deal with the major changes of our Planet in an holistic view. The research activity of the DST is organized in three sections. https://www.dst.unifi.it/index.html?newlang=eng

## KEY RESEARCH ACTIVITIES

### Section 1

- Characterization of the crystallographic structure of specific natural and/or synthetic mineral phases for industrial applications and also for their potential use as and their re-use as secondary raw materials.
- Characterization of stone material used in historic/prehistoric building and/or artifacts to evaluate their provenance and the response to chemical/mechanical alteration specifically related to pollution.
- Mineral and chemical characterization of natural resources (reserves and subeconomic resources) for comprehensive evaluation of the genesis and potential extraction of critical raw materials (CRMs).
- Chemical and isotopic characterization of natural water, water/rock interaction, thermodynamic of hydrological cycle, climate changes, pollution.
- Chemical and isotopic investigation of air and air particulate (e.g. PM10, organic components and so on) in urban areas to investigate and discriminate the sources of pollution.
- Definition and discrimination of natural vs anthropic sources of potentially toxic elements (PTE, e.g., heavy metals, thallium, mercury, and so on), their presence and mobility in both urban and extra-urban environment.
- Determination of the morphological, mineral chemical and crystallographic, petrographic, geochemical and isotopic characteristics of natural matrices (rocks, fluids and gasses) of active and quiescent volcanoes worldwide.
- Dynamics of complex systems, methods to quantify reliance, identify regime shifts and tipping points by HPC, neural network, IA, machine learning.
- Investigations on natural cycles and budget of specific elements and/or compounds (e.g., REE, $CO_2$) to understand the anthropic impact on climate.

## ERC MAIN RELEVANT PANELS

- **PE1 Mathematics** [PE1_15; PE1_21]
- **PE4 Physical and Analytical Chemical Sciences** [PE4_18]
- **PE10 Earth System Science** [PE10_3, PE10_4, PE10_5, PE10_6, PE10_7, PE10_8, PE10_9, PE10_10, PE10_11, PE10_12, PE10_13, PE10_14, PE10_17, PE10_19, PE10_20, PE10_21]
- **LS8 Environmental Biology, Ecology and Evolution** [LS8_2, LS8_9]
- **SH5 Texts and Concepts** [SH5_5]
- **SH6 The Study of the Human Past** [SH6_2, SH6_5]
- **SH7 Human Mobility, Environment, and Space** [SH7_9, SH7_10]

- Geological geochemical and isotopic fingerprinting of food products (e.g. wine, olive oil) for tracing and potentially certifying their geographic provenance.
- Mineralogical, crystallographic, mineral chemical, petrographic, geochemical and isotopic characterization of extra-terrestrial objects (e.g. meteorites) to define they conditions of formations and to constraint the evolution of the Solar system and its planetary bodies.
- Mineralogical and cosmochemical studies to characterize a new state of matter: quasicrystalline materials recovered in exotic extraterrestrial objects.
- Multi-disciplinary investigation of volcanic systems, including the processes responsible for magma genesis and evolution, to the eruptive dynamics and the geochemical monitoring (gas and water).
- Physical volcanology of past and on-going eruptions through the geological, textural and compositional study of eruptive deposits and products. Mapping of volcanic terrains.
- Magmatic volatiles in melts and glasses and their role in explosive eruptive dynamics.
- Volcanic hazards assessment, eruptive scenarios definition and probabilistic hazard mapping at active volcanoes.

## Section 2
- Geoarchaeological analysis applied to define the interaction between humans and the environment throughout the Holocene; Environmental sedimentology for tracing geogenic vs anthropogenic dispersal of toxic elements in the sedimentary matrix.
- Geophysical volcanology, infrasound acoustics, seismic hazard and vulnerability, seismic and infrasound propagation modeling. Early-Warning system in volcano environment.
- Integration of geology, seismology, ground deformation, and numerical modelling to constrain geodynamic processes and fluid flow relevant for earthquake geohazards and geothermal resources.
- Paleoenvironmental, paleoclimatic and stratigraphic reconstructions using palynological analysis especially in terrestrial and marine deposits of the Neogene and Quaternary of the Mediterranean area. Global warming and biodiversity in Holocene wetlands with associated dissemination activities and citizen science projects.
- Paleontology and Paleobiology; Virtual Paleontology; Paleontological Heritage; Conservation Paleobiology; Paleoenvironmental reconstructions; Paleoecological reconstructions; Evolutionary history reconstructions; Taxonomy and Systematics; Vertebrate ichnology.
- Paleoecological and paleoclimatic reconstructions using the fossil record of marine invertebrates. Past extinction and turnover events, reconstruction of ecological baselines pre-Anthropogenic impact, sclerochronology.
- Regional Geology of the Mediterranean area. Geothermics and geothermal applications. Geology of the cultural heritages. Geology of the crystalline basements. Sedimentology of turbiditic successions.
- Sedimentology and Stratigraphy of continental and shallow marine successions in different geodynamic settings; depositional processes in terrestrial siliciclastic and carbonate deposits; Reservoir analogues in carbonates: characterization and modeling.
- Palaeoceanography, palaeoclimatology, and stratigraphy of Mesozoic and Paleozoic marine sediments using sedimentology and sedimentary geochemistry. Depositional processes of organic facies from continental to deep marine settings. Source rock sedimentological characterization and modeling.
- Structural analysis of deformations and reconstruction of geological evolution in different geodynamic settings (mainly rifting, subduction zones and mountain building), through field studies, seismic lines interpretation, analogue modeling, rock mechanics, remote sensing, and seismo-tectonics.

## Section 3
- Earth Observation data, and regional forecasting models to detect, map, monitor and forecast ground deformations as well as the development of regional and national quantitative landslide risk assessment procedures.
- Natural and artificial stone materials characterization and study of physical, chemical and mechanical stone degradation phenomena. Investigation and monitoring process typically involves using non-destructive testing techniques such as ultrasound, infrared thermography, and laser scanning to detect any structural defects or changes that may occur over time.
- Research and development on advanced technologies and new methodologies for the prevention and management of landslide risk to support policies and actions of risk reduction, focusing on landslide monitoring and early warning using innovative technologies.
- Prevention and Sustainable Management of Geo-Hydrological Hazards, threatening the human life, property, cultural heritage and the natural and built environment (UNESCO Chair established in 2016).

- Research on karst landforms and processes, with particular attention on underground systems. Investigations concern three major issues: Geomorphology and morphotectonic of karst areas, karst hydrogeology, impact of climate on groundwater dynamics.
- Investigations on soil genesis, paleo- and archeo-pedology; methodological problems in soil survey; applications of remote sensing and GIS technologies to soil survey; genesis and monitoring of forest soils.
- Fluvial dynamics, morphological variations and evolution of river beds and effects of anthropic interventions; monitoring, modeling and analysis of erosion processes and failure mechanisms of river banks.

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

## *Laboratories (alphabetic order)*

- Analogue structural modeling
- Analysis of Trace and Ultratrace Elements (LAETU)
- Archaeometry and environmental mineralogy
- Crystallography
- Experimental Mineralogy and Petrology
- Experimental Geophysics Laboratory
- Fluid Geochemistry
- Fluids And Rocks Geochemistry
- Geochemistry of Radiogenic Isotopes
- GIS and thematic mapping laboratory
- In-house and on-field Geophysical labs and network
- Micro Analysis (LaMA)
- Optical cold cathodoluminescence
- Paleontology (invertebrates and vertebrates) and 3D
- Palynology
- Petrography Applied to Cultural Heritage
- Petrophysic
- Remote Sensing laboratory specialized on SAR interferometry, optical multi- and hyperspectral remote sensing
- Rock and Soil mechanics laboratory
- Sedimentary Petrography
- Soil solution analysis
- Stable Isotopes Geochemistry
- Stone Materials, Engineering Geology, Environmental and Landscape
- Structure and Tectonics: Experiments, Numerics, Observations (STENO Lab)
- Volcanology
- X-Ray Laboratory
- 3D Digital Geology
- 3D-Digital and photogrammetry

## *Equipment (alphabetic order)*

- Access to real-time meteorological services
- Advanced geotechnical and hydrogeological modelling software
- Advanced photogrammetric modelling software
- Atomic Absorption: Perkin Elmer AAnalyst 100, LUMEX mercury analyzer for liquid samples RA-915M/RP-92
- Atomic fluorescence: PSA Merlin, PSA Excalibur
- Autonomous Underwater Vehicle with camera and sonar
- Cavity Ring-Down Spectroscopy CRDS analyzer for CO2, CH4 & related $\delta$13C, PICARRO G2201-I
- Cavity Ring-Down Spectroscopy CRDS analyzer for H2O isotopes H2O, PICARRO L2130-I
- Chromatography: Metrohm 761 Compact IC, Metrohm 861 Advanced Compact IC
- Compact submarine remotely controlled (NEMO-ROV)
- Copahue infrasonic network: 1 infrasonic array, 1 seismic station
- Digitizers guralp EAM-DM24 4 bit 4-7 channels
- Direct mercury analyzer, Milestone DMA-80 evo
- Electrical resistivity, electromagnetic and seismic surveying instrumentation
- Electron Microprobe (EMPA), JEOL-JXA 8230, for in situ determination
- Etna multiparameter network: 2 infrasonic arrays, 1 seismic station, 2 visible camera, 1 thermal camera
- Fieldspec spectroradiometer
- Gas-Chromatography: Shimadzu GC-15°, Shimadzu GC-14° (2), Thermo Focus GC
- Gas-Mass: Thermo Trace GC Ultra – DSQ, DANI Master TD, Teledyne Tekmar Stratum Purge & Trap
- GBInSAR portable monitoring systems
- GPS and topographical survey instrumentation
- Ground Penetrating Radar (GPR)
- Guralp CMG-T40 seismometers
- Huber goniometer heads with adjustable X, Y, Z axes for single-crystal X-ray diffraction
- Inductively Couples Plasma Mass Spectrometer (ICPMS), Agilent 7800
- Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES) Perkin Elmer ICP-OES Optima 8000 Spectrometer + HG.
- Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES) Thermofischer iCAP PRO XP
- Infrared thermal camera
- Infrasonic network Iceland: 5 infrasonic arrays
- Lennartz LE-3D/5s seismometers
- Lennartz LE-3Dlite seismometers
- Lunitek Atlas 24 bit 3-6 channel digitizers
- Meta QUEST 3 visors (10), software and hardware for augmented reality
- Microwave mineralizer Milestone CEM Mars-5. CEM MARS-6
- Particle static analyser Malvern Morphologi 3Gs
- Optical cold cathodoluminescence
- Poro-Permeameter (Gas)

- Portable instrument for airborne Hg analysis, Lumex 915M
- Portable analyzer: GA 2000 multigas, EDA Radon analyzer RD 200, LUMEX Hg analyzer (AAS) in air, Portable FID for CH4 CROWCON Gas Tec, Accumulation chamber WEST SYSTEM for CO2 fluxes
- Pulsed Fluorescence: Thermo Electron mod. 4501 H2S and SO2 analyzer in air
- Rock and soil mechanics field and laboratory equipment
- Robotized total stations
- Samplers TECORA Echo PM (2)
- Samples preparation and separation line for the isotopic analysis of δ18O and δ2H (water), δ13C and δ18O of CO2 (Gas, Carbonates)
- Soil solution analysis laboratory equipment
- Spectrometers, Thermofisher Triton-Ti and Triton-Plus
- Spectrophotometers: (HACH DR/2010, HACH DR/2000 Philips Pye Unicam SP6-350)
- Spot mobile robot for automatic sensing and inspection
- Stone Materials laboratory equipment
- Stromboli multiparameter network: 2 andometric buoys, 2 FLIR cameras, 2 visible cameras, 5 seismic-acoustic stations, 3 borehole tilt, 1 surface til, 1 infrasonic array
- TECORA AYRON 5 samplers of atmospheric gases with tri-phasic traps for Volatile Organic Compounds (VOCs) analysis
- Titration (Metrohm 794 Basic Titrino; Metrohm 645 Dosimat)
- Tuscany seismic network: 9 broadband seismic stations
- Two Multicollector Thermal Ionisation Mass.
- UAV (Uncrewed Aerial Vehicle), SATURN and SATURN mini
- UAV Fixed Wing
- UAV Near Infrared camera
- UAV High resolution digital camera
- UAV laser scanner
- UAV Infrared Thermal sensor
- UAV Ground Penetrating Radar (GPR)
- UAV VNIR hyperspectral camera (400-1000 nm)
- UAV NIR hyperspectral camera (900-1700 nm)
- Ultra Clean Lab for the dissolution of samples and chemical separations for isotopic measurements, equipped with a microsampling systems, ESI Micromill 2.
- Wireless sensor networks
- X-ray diffractometers for powders Philips Model PW 1050/37, with a Panalytical X'Pert PRO data acquiring system, operating with a Cu anode, a graphite monochromator (limit of detection 4%).
- X-ray fluorescence: ELIO-Portable Micro-XRF Spectrometer with Mapping Option
- 3D laser scanners
- 3D Structured light scanners
- 3D printers

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

- L.S.B. Leakey Foundation for Anthropological Research, San Francisco (U.S.A.) – Project "**Geo-Paleontological investigation investigations at the Buia hominid site, Eritrea**", 2000-2005.
- CEE, European Commission 5th FP – "**ERUPT – "Processes and Timescales of Magma Evolution in Volcanic Systems**", 2002-2005.
- National Geographic Society, Committee for Research and Exploration, Washington D.C, (U.S.A.) – Project "**Pleistocene Homo erectus (and other mammals) dispersal pathways along the western coasts of the Red sea (Eritrea and Sudan)**", 2005-2006.
- The Wenner-Gren Foundation for Anthropological Research, New York (U.S.A.) - Project "**Early Pleistocene archeological sites of western Sudan**", 2006-2007.
- Marie Skłodowska-Curie Actions - Innovative Training Networks (ITN): "**PUSHH" Palaeoproteomics to Unleash Studies on Human History** , 2010-2011.
- National Geographic Society, Committee for Research and Exploration, Washington D.C, (U.S.A.) – Project "**Fossil mammals of Late Miocene Libyco-Chadian Province in southern Italy**", 2010-2011.
- **ARISE** (2012-2014 FP7) and **ARISE2** (2015-2018), H2020, Atmospheric dynamics Research InfraStructure in Europe: Design studies for a research infrastructure for the dynamics of the upper atmosphere, 2012-2018.
- **FUTUREVOLC** (2012-2016 FP7): European supersite for development of new monitoring solutions of active volcanoes, 2012-2016.
- Air quality: specific geochemical markers of geothermal power plant input into atmosphere - **Patos II** - Tuscany Region, 2013.
- NERC Large Grant (UK), "**Rift volcanism: past, present, future - RiftVolc**", 2014-2017.
- LIFE **SMART4Action** "**Sustainable Monitoring And Reporting To Inform Forest- and Environmental Awareness and Protection**", 2014-2018.
- PNR Cultural Heritage: "**The Times of Castles. Multidisciplinary researches for a new chronology of the building sites of incastellamento (XI-XI centuries)**", 2015-2020.

- M.I.U.R.-P.R.I.N., "**TEOREM deciphering geological processes using Terrestrial and Extraterrestrial ORE Minerals**", 2017.
- M.I.U.R.-P.R.I.N. "**Micro to Macro - How to unravel the nature of the Large Magmatic Events**", 2017.
- M.I.U.R.-P.R.I.N., "**Distribution of strain and magmatism during rifting**", 2017.
- M.I.U.R.-P.R.I.N., "**Detailing thE Palaeogeography of Southern Palaeoeurope by meanS of biosTratigraphic correlation and basin development in the Palaeozoic to early Mesozoic time-frame: case histories from the Italian record (DEEP PAST)**", 2022.
- **EUROVOLC** (H2020): **European supersite for development of new monitoring solutions of active volcanoes**, 2018-2022.
- ASI-INAF , "**Olivine-bearing ungrouped achondrites and their parent bodies in the Solar System**", 2019.
- Research Project of National Relevance - National Institute of Astrophysics PACMAN - "**3200 Phaethon Asteroid Composition by Multiple Analysis**", 2019.
- Competitive project for temporary researchers of UNIFI "**SENECA- Streams in the urban landscape: evaluating the chemical/ecological status for sustainable city Planning**", 2019.
- CR Firenze Foundation "**Monitoring mercury concentrations and speciation in the botanical collections of the Museum of Natural History and the Center for Tropical Herbarium Studies at the University of Florence: impact on the usability of the collections and on the health of frequent visitors**", 2019.
- CR Firenze Foundation **MiDAE - Micro Diffraction and Elemental Analysis**, 2019.
- European Environment Agency (EEA) **Copernicus European Ground Motion (EU-GMS)**, 2019-2021.
- "**POLlen et ARIdité, résilience de la végétation aux SÉcheresses récurrentes - POLARISE**" 2020.
- **International Research Network (IRN)**. RTM. 2020-2023 - URBO–Urbi et Orb(etello). IMU 2020 (Géoarchéologie – Bathymétrie – Palynologie),  2020.



- ASI-INAF "**Development of a pressure/temperature controlled chamber for the study of spectral properties of planetary analogues and meteorites, in support to the interpretation of data from current/future space missions to minor bodies and icy moons**", 2020.
- Simons Foundation contribution (New York, USA) and private benefactors on "**Natural quasicrystals**", 2020.
- CR Firenze Foundation "**A window on the Solar System: project on the spectroscopic characterization of bolides**", 2020.
- Framework agreement Italian Space Agency-National Institute of Astrophysics (ASI-INAF) "**Scientific activities of the Hayabusa2 space mission**", 2020.
- Tuscany Region, Call for YOUNG RESEARCHERS FOR CULTURE, "**AirMuseum Air quality: environmental monitoring and technological solutions for the usability and preservation of museum collections**", 2020.
- ESMERA (Boosting Robotics Innovation) European Consortium **ROMERO (Robots for Extreme Environments**, 2020-2021.
- **EUSATfinder, a European SME Robotics Application**, 2020-2023.
- **PassPORT-Operational Platform managing a fleet of semi-autonomous drones exploiting GNSS high Accuracy and Authentication to improve Security & Safety in port areas**, H2020, 2020-2023.
- UNIFI Infrastructures project,  acquisition of a **Microdrill equipment**, 2021.
- Research Project of National Relevance - National Institute of Astrophysics **MELODY - Moon multisensor and Laboratory Data Analysis**, 2021.
- Bank of Italy **Characterization of meteoroids through the spectroscopic observations and historical-scientific study of the Italian meteorites**, 2021.
- "**Susceptibility estimation for Landslides in the Hellenic Territory – Volcanic Hazard and Risk Assessment - GEOKA**" - HSGME, Greece - Petrologic, geochemical and isotopic studies of selected volcanoes from the South Aegean Active Volcanic Arc, Greece", 2021.
- POR-FESR14-20 **ATLANT Development of high-tecnology laser instrument for remote monitoring building**, 2021-2022.
- European Space Agency (ESA) **PATHFINDER PNT as A TecHnology to support drones' BVLOS scenarios for preventive monitoring and FIrst respoNDER missions**, 2021-2022.
- World Bank Strengthening **SFRARR Financial Resilience and Accelerating Risk Reduction in Central Asia**, 2021-2022.
- Horizon 2020 **GEOENVI "Tackling the environmental concerns for deploying geothermal energy in Europe",** , 2021-2022.
- Horizon 2020 **LITRASV Life in travertine and sinter veins: a possible key to recognize extra-terrestrial life in tectonically-driven depositional system**, 2021-2022.

- Horizon 2020 **LINKS Strengthening Links between Technologies and Society for European Disaster Resilience**, 2021-2022.
- PRIN INAF "**PACMAN 3200 Phaethon Asteroid Composition by Multiple Analysis**", 2021-2024.
- LIFE20 "**MODERn (NEC) new MOnitoring system to Detect the Effects of Reduced pollutants emissions resulting from NEC Directive adoption**", 2021-2025.
- RTM Spanish government **EVAMED New evaporite records from the Eastern and Western Mediterranean: contributions to the evolution of the last saline giant and opportunities for the energy transition**, 2021-2025.
- European Space Agency (ESA) **G-Class Hydroterra (an Earth Explorer mission for Water Cycle Science**, 2019-2020.
- UNIFI Infrastructures project acquisition of a **microtomography with high resolution**, 2022.
- Italian Space Agency- University of Bologna (ASI-UniBO) "**Scientific activities for the HERA space mission**", 2022.
- MUR PNRR **National Centre for HPC, Big Data and Quantum Computing. Dynamics of complex Mediterranean river catchments**, 2022.
- HSGME Hellenic Survey of Geology and Mineral Exploration "**COLLECTION Isolation and initial identification of microorganisms in extreme environments volcanoes**", 2022.
- Regione Sicilia and INGV "**IRGIE Inventory of Geothermal Resources Aeolian Islands**", 2022.
- MUR PRIN "**HYDROX - HYDRous- vs OXo-components in minerals: adding new pieces to the Earth's H2O cycle puzzle**, 2022.
- MUR-PNRR "**CHANGES Cultural Heritage Active Innovation for Sustainable Society**", 2022.
- ECHO EU **EGMS RASTOOL European ground motion risk assessment tool**, 2022-2024.
- ARPAT-DST "**Mercury survey monitoring in the Mt. Amiata district for the portion related to the regional territory in the river courses of the Paglia River**", 2022-2024.
- PNRR "**Environmental monitoring and (paleo)biodiversity analysis through museum collections and field activities in protected areas**", 2022-2025.
- PNRR, **National Biodiversity Future Centre, spoke 7**, 2022-2025.
- PNRR Infrastructure **ITINERIS, PE3, RETURN**, 2022-2025.
- PRIUS Premier Research Institute for Ultrahigh-pressure Sciences, "**Structural study of phase H, (MgSiH2O4), a potential high-pressure carrier for water to the deep lower mantle**", 2023.



- UNIFI Infrastructures project, acquisition of a **analytical system DPIV – Digital Particle Image Velocimetry** 2023.
- Galileo Program (French-Italy) "**BIOMED Which future for the Mediterranean biodiversity? Images from the past for a sustainable future**", 2023-2024.
- Pianeta Dinamico **EMOTION Geochemical characterization of fluid manifestations in central-northern Italy for geothermal assessment and development of the geothermal fluid national web portal**, 2023-2025.
- ERC Advanced Grant "**LATEUROPE Why late earliest occupation of Western Europe?**", 2023-2027.
- MSCA Doctoral Network "**TALENTS The doctoral rift science network for the energy transition**", 2024-2027.
- MSCA Staff Exchanges "**LOC3G Localization in Geophysics, Geohazards and Geoengineering**", 2024-2027.
- UNIFI – INGV "**Volcanic Monitoring and Early warning system of tsunami and paroxysm explosion at Stromboli**", 2022-2024.
- MUR PRIN "**TEAMS TErrestrial And Marginal System in a hot world. The continental and marginal-marine Cenomanian environments of the Southern Morocco between climate extreme and regional tectonics**", 2022-2025.
- MUR PRIN "**HEATED - PHreatic Eruptions at AcTive volcanoEs: processes, source parameters and physical models of eruption Dynamics**", 2022.
- MUR PRIN "**OPENLIT Building An Open Access Lithotheque Of Italian Knappable Rocks Exploited During Prehistory**", 2022.
- MUR PRIN "**TRANSIENT. Time-integRAted melt-depletioN SIgnature in an Evolving sub-ridge maNTle**", 2022.
- MUR PRIN "**FORMATION Full coverage multiscale and multisensor geomorphological map: a practical tool for territorial planning**", 2023-2025.
- MUR PRIN PNRR "**Causes and consequences of deposit-derived pyroclastic density currents**", 2023-2025.
- MUR PRIN PNRR "**SMILE Statistical Machine Learning for Exposure development**", 2023-2025.
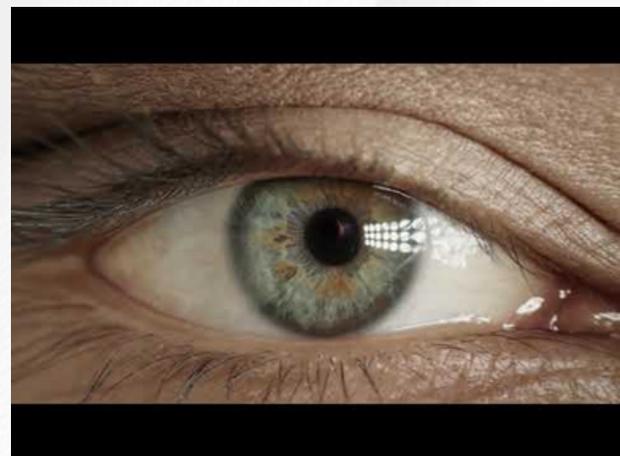
- MIUR PRIN PNRR "**MOLIERE The antimony resource in Italy: evaluation of environmental impact and ore exploration of a critical raw material**", 2022.
- MUR PRIN-PNRR "**RESILIENCE - Refine Eruptive Scenarios and Impact reLated to phreatomagmatIc EruptioNs at Campi FlegrEi (Italy)**", 2022.
- Competitive projects for Fixed Term Researchers (RTD) from the University of Florence "**COMBINE, COupling MicroBes and mINErals for treating heavy metal containing waters**", 2024-2025.
- MUR Rita Levi Montalcini programme "**Marine benthic community response to climate change: the Mid Pliocene Climatic Optimum**", 2018-2021.
- PRIN "**Ecological effects of species range-expansions driven by climate: insights from the Last Interglacial (MIS5e, Pleistocene) of the Mediterranean Sea**", 2022.

**CONTACTS**

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# DEPARTMENT OF STATISTICS, COMPUTER SCIENCE, APPLICATIONS "G. PARENTI"

www.disia.unifi.it

DiSIA is the landmark of the University of Florence for all subjects concerning the development of quantitative methods and the acquisition, processing, and elaboration of data (however heterogeneous it may be) with the aim of extracting the information it contains and transforming it into available knowledge.

In this regard, the Department organizes research, teaching, and training activities, as well as transmission of knowledge and innovation, in line with the transverse nature of the subjects it covers. DiSIA aims to be a point of reference and aggregation for all subjects related to data science at the University. The DiSIA members belong to several scientific sectors, including Computer Science, Medical Statistics, Econometrics, Commodity Sciences, Statistics, Economic Statistics, Demography, and Social Statistics, and are organized within the following areas: Mathematical and Computer Sciences, Medical Sciences, and Economics and Statistics.

Despite this heterogeneity, the Department members share a common view in which attention to data (and the information contained in it) is combined with a strong focus on applied and experimental areas, in line with specific scientific sensitivities and skills.

The DiSIA offers its expertise in support of teaching and training activities in several Schools of the University, with the aim of training professional figures suited to the growing demand for skills in the field of information processing and analysis, also stimulating the necessary sensitivity to the specific characteristics of the field of application. DiSIA boasts numerous international collaborations, fostering robust partnerships with esteemed Institutions and organizations worldwide.

## ERC MAIN RELEVANT PANELS

- **PE1 Mathematics** [PE1_13, PE1_14, PE1_15, PE1_17, PE1_19, PE1_20]
- **PE4 Physical and Analytical Chemical Sciences** [PE4_2, PE4_5]
- **PE6 Computer Science and Informatics** [PE6_2, PE6_3, PE6_4, PE6_5, PE6_6, PE6_7, PE6_11]
- **LS2 Integrative Biology: from Genes and Genomes to Systems**
- **LS7 Prevention, Diagnosis and Treatment of Human Diseases**
- **SH1 Individuals, Markets and Organisations** [SH1_1, SH1_8]
- **SH3 The Social World and Its Interactions** [SH3_7, SH3_9]
- **SH7 Human Mobility, Environment, and Space** [SH7_2, SH7_3, SH7_4, SH7_5, SH7_6, SH7_7]
- **SH8 Studies of Cultures and Arts** [SH8_1]

DiSIA has been appointed the second time in a row (2018-2022, 2023-2027) as Department of Excellence among Italian universities by the Italian Ministry of Research and University (MUR). The award consists of a five-year special funding to strengthen and enhance excellence in research and teaching. It is an important recognition of the excellence of the research produced by researchers of the Department. The funding enables the strategic development project to strengthen DiSIA's role as a national and international reference center for the disciplines involved in generating knowledge through processing data to support decision-making processes.

# KEY RESEARCH ACTIVITIES

DiSIA members are engaged in the following research topic areas:

- Statistical information systems for the analysis of
- complex contexts
- Causal inference
- Biostatistics
- Economics and Finance
- Clinical and Epidemiological Research
- Medical Statistics and Evidence Synthesis
- Population and Society
- Design of experiments, statistical quality control

- Computer Science: algorithms, languages, formal methods, and security
- Quantitative analysis of tourism-related phenomena
- Inferential methods for finite populations
- Assessment of the quality and sustainability of production chains
- Methodological Statistics

A full description of the research topics is available at https://www.disia.unifi.it/p344.html

# KEY RESEARCH FACILITIES, INFRASTRUCTURE, AND EQUIPMENT

DiSIA is involved in the following Research Centers or Networks:

- **Florence Center for Data Science**
- **StEering**: Statistics for Engineering: design, quality, and reliability
- **Camilo Dagum on Advanced Statistics for the Equitable and Sustainable Development**
- **CIBIACI**: Interdepartmental Center for Biotechnology Services of Agricultural, Chemical, and Industrial Interest
- **BETTER**: Bioeconomy Laboratory For Agricultural Wastes Valorisation
- **VAC4EU**: DiSIA serves as the reference department at the University of Florence within The Vaccine Monitoring Collaboration for Europe (VAC4EU), a European collaborative research network dedicated to monitoring vaccine benefits and risks.

We also mention **DiSIA-Lab** (Laboratory of Statistics and Computer Science), a research unit of DiSIAestablished by resolution of the Department Council in July 2014.
DiSIA-Lab was created to meet specific teaching and research needs, to serve transfer and innovation projects, and to enhance DiSIA's collaborative relationships with other organizations, inside and outside the University. The tasks of the DiSIA-Lab also include the operational management of IT resources, equipped classrooms and data collection systems within the DiSIA, including:

- Three multimedial rooms, in total 98 stations with Thin Clients, aimed at teaching activity
- Infrastructural Server whose aim is to handle virtual servers (DELL PowerEdge R740xd, 2 CPU Intel(R) Xeon(R) Gold 6238R CPU @ 2.20GHz 28 core, 1 TB RAM)
- Servers for research activity (2x Lenovo ThinkSystem SR950, with 8 CPU Intel(R) Xeon(R) Platinum 8260 CPU @ 2.40GHz 24 core, 6 TB RAM)
- Storage Unit (NAS LENOVO DM5000H having 12 SSD disk with 894GB)

The DiSIA-Lab is run by all the technical and teaching staff of the DiSIA, coordinated by Prof. Bruno Bertaccini.

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

- **Department of Excellence 2023-2027**
- **Department of Excellence 2018-2022**
- **EU-FER**, PI Prof. Daniele Vignoli, HORIZON 2020 ERC, https://eu-fer.com/
- **Complex graphical models for biological network science**, UNIFI Leader: F.C. Stingo, PRIN 2022 (2023-2025)
- **DLT-FRUIT** A user centered framework for facilitating DLTs FRUITion, UNIFI Leader: A. Marino, PRIN 2022, (2023-2025)
- **E3DM - Experimental Design and Maintenance, a Decision-Making approach driven by Degradation Models**, UNIFI Leader:Rossella Berni, PRIN 2022, (2023-2025)
- **From high school to university: Assessing peers' influence in educational inequalities and performances**, UNIFI Leader: V. Tocchioni, PRIN (2023-2025)
- **KinHealth** Beyond the nuclear family: Extended kinship and mental health in Italy, UNIFI Leader: V. Tocchioni, PRIN 2022 (2023-2025)
- **Latent variable models and dimensionality reduction methods for complex data**,  UNIFI Leader: L. Grilli, PRIN 2022, (2023-2025)
- **NextGRAAL** Next-generation algorithms for constrained GRAph visuALization, UNIFI Leader: A. Marino, PRIN 2022 (2023-2025)
- **The pre-Covid-19 stall in life expectancy in Italy: looking for explanations**, PI: G. De Santis, PRIN 2022 (2023-2025)
- **WelFerPoli** Well-being and Fertility Policies, UNIFI Leader: R. Guetto, PRIN 2022, (2023-2025)
- **Age-It** Ageing Well in an Ageing Society, SC: D. Vignoli, PNRR
- **Assessment cybersecurity readiness**, PI: Rosario Pugliese, POR FESR 2014-2020, Regione Toscana, (2019-2021)
- **CREW** Care, Retirement and Wellbeing, PI: G. De Santis, JPI More Years Better Life (2019-2021)
- **CIRCULARFOOD** Circularity and innovation: applying sustainable models in the agri-food supply chain-SRG01 - "SOSTEGNO AI GRUPPI OPERATIVI PEI AGRI", UNIFI Leader: P. Vignolini, FEASR 2023-2027, Regione Toscana (2026-2028)
- **GDR** Great Demographic Recessione, PI: D. Vignoli, PRIN Project, (2019-2021)
- **Joint Bayesian Learning of Related Clinical Studies**, UNIFI Leader: F. C. Stingo, Fondazione CARIPLO, (2025-2027)
- **PRESSPAD** Green agriculture products extraction process PSR 2014-2020 Maremma, Regione Toscana
- **PT GREEN - ProdoTti GREEN per il florovivaismo e l'agricoltura: utilizzo di matrici vegetali e valorizzazione circolare di scarti del settore per la produzione di estratti innovativi**, UNIFI Leader: P. Vignolini, Fondazione Caript (2024-2026)
- **PizzaAgricola**: An innovative and certified regional organic and biodynamic network for the creation of an agricultural supply chain for Tuscan pizza, UNIFI Leader: P. Vignolini, PSR 2014-2022 Regione Toscana

A full description is available at https://www.disia.unifi.it/ (section Projects).

## CONTACTS

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# DEPARTMENT OF ECONOMICS AND MANAGEMENT

www.disei.unifi.it

The Department of Economics and Management (DiSEI) is a multidisciplinary research hub that integrates economics, business management, law, and quantitative methods. DiSEI is committed to addressing complex global challenges, from sustainability and digital transformation to public governance and financial regulation, by fostering a research environment that attracts talent from diverse fields, including political science, law, and social sciences. DiSEI was established in 2013 as the natural successor to the Faculty of Economics and Business, which was founded in 1935 and was based in Villa Favard until 2004.

DiSEI is currently composed of more than 100 Professors and Researchers, supported in its various activities by technical administrative staff and research personnel such as doctoral students, postdoctoral fellows, research fellows, and contract workers. The focus of DiSEI's research is on both theoretical and empirical areas across the fields of Economics and Business sciences, but with contributions from Agricultural, Mathematical, Geographical, Legal, and Historical sciences. DiSEI is responsible for three bachelor's degree programmes taught in Italian and one fully taught in English, as well as five master's degree programmes.

The Department contributes to several doctoral programs: it is the administrative headquarters for two Doctoral Programs in Development Economics and Local Systems (DELOS) and Social Sciences for Sustainability and Wellbeing (S3W) and is also a member of the Doctoral Programme in Economics of the Tuscan Universities and of the Doctoral Programme in Business Economics and Management.

## ERC MAIN RELEVANT PANELS

- **SH1 Individuals, Markets and Organisations**
- **SH2 Institutions, Governance and Legal Systems**
- **SH4 The human Mind and Its Complexity**
- **PE1 Mathematics**
- **PE6 Computer Science and Informatics (Data Science applications)**

## KEY RESEARCH ACTIVITIES

DiSEI's key research activities span both theoretical and empirical domains within economics and business sciences, with interdisciplinary contributions from agricultural, mathematical, geographical, legal, and historical studies. Given that DiSEI currently has more than 100 professors and researchers, this large number of faculty members implies a wide variety of research interests, ranging from economic sciences—such as microeconomics, macroeconomics, mathematical and dynamic economics—to applied fields including behavioral economics, environmental economics, development and sustainability economics, and entrepreneurial economics. The department's expertise also extends to business economics and management, as well as to several areas of finance, including financial economics, corporate and quantitative finance, banking, insurance, and financial econometrics, together with accounting and related disciplines within the broader field of business and social sciences.

The research working papers of DiSEI members are published in (https://www.DiSEI.unifi.it/vp-584-publications.html?newlang=eng) and are divided in 4 thematic areas: Economics, Business, Law, Economics and Social Rights, Quantitative Methods for Social Sciences.

DiSEI research seminars are regularly held every Tuesday at lunchtime, see: https://www.DiSEI.unifi.it/vp-583-seminars.html

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

DiSEI is supported by extensive physical and human research infrastructure and actively participates in the following research centres (https://www.DiSEI.unifi.it/vp-25-centri-di-ricerca.html):

- Research Center on Games for Social Change (Gix) - Centro di Ricerca sui Giochi per il Cambiamento Sociale (Gix)
- Interdepartmental Research Center for Food Valorization (Ce.R.A.) - Centro di Ricerca Interdipartimentale per la Valorizzazione degli Alimenti (Ce.R.A.)
- Florence Center for Data Science (FCDS): An interdepartmental center for big data analysis and artificial intelligence applications.
- NetBheeLab (Network, Behavioral, Heterogeneity and Evolution in Economics): Exploring complex economic systems and behavioral heterogeneity.
- BEELab+ (Behavioral and Experimental Economics Lab): A facility for conducting controlled experiments on individual and collective economic decision-making.
- LISET (Laboratorio di Innovazione Sociale, Economia e Territorio): Focused on social innovation and regional economic development.
- CSDC (Center for the Study of Complex Dynamics): Interdisciplinary research linking economics with physics and mathematics.
- Interuniversity Research Center for Experimental Economics (CIES). CIES is a network of scholars working in five experimental economics laboratories at the Universities of Siena, Modena-Reggio Emilia, Pisa, Salerno, and Florence.
- Interuniversity Research Center for Statistics for Engineering: Design, Quality, and Reliability (StEering) - Centro di Ricerca Interuniversitario di Statistics for Engineering: Design, Quality and Reliability (StEering)
- Interuniversity Research Center for Economics Applied to Industrial, Local Development, and Internationalization Policies (CiMET). CiMET is a community of researchers active in the social sciences, motivated by a desire to understand what happens in the "real world." Through their activities, they aim to offer a relevant and rigorous contribution to the national and international academic and political debate.
- Interuniversity Research Center for the Documentation of Italian Economic Thought (CIPEI) - Centro di Ricerca Interuniversitario di Documentazione del Pensiero Economico Italiano CIPEI.

The following research labs are currently active: Data Life Lab - Scientific Manager; Real Estate Lab - Scientific Manager.

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

DiSEI's research activities focus on both social science theory and applied aspects. Therefore, DiSEI's research has a significant impact on strategic sectors at the local, regional, national, and international levels, as demonstrated by the number and quality of its funded research projects, both nationally (PRIN/PNRR and other ministerial projects, etc.) and internationally (Horizon Europe, H2020, including ERC and FET).
See: https://www.DiSEI.unifi.it/vp-578-research-projects.html, https://www.DiSEI.unifi.it/vp-484-progetti-di-ricerca.html

**International Research Project:**

- GI SMART - Geographical Indications' contribution to smart territorial development and sustainability. Insights for GIs producers, policy makers, consumers and local communities: HORIZON Research and Innovation Actions. 2024-2028
- EGSL - European Game Science Lab. ERASMUS+ KA2 Partnerships for Cooperation HE. 2024 - 2027
- SPES – Sustainability Performances, Evidence and Scenarios: HORIZON-CL2-2022-TRANSFORMATIONS-01-01. 2023-2026
- COACH - Collaborative Agri-food Chains: Driving Innovation in Territorial Food Systems and Improving Outcomes for Producers and Consumers: Horizon 2020 - H2020-RUR-2018-2020 / H2020-RUR-2020-1. 2020-2023
- EUROSHIP-Closing gaps in social citizenship. New tools to foster social resilience in Europe, H2020-SC6-GOVERNANCE-2018-2019-2020/H2020-SC6-GOVERNANCE-2019. 2020-2023
- DEFA - Development of financial autonomy of universities in Kyrgyzstan: Erasmus+ KA2 Capacity Building for Higher Education. 2023-2026.
- HEADCET - Higher Education pArtnerships for sustainable local Development through Circular Economy and social innovaTion: Erasmus+ KA2 Capacity Building for Higher Education. 2023-2025.
- ORM - Online reputation management v cestovním ruchu: Erasmus+ KA203 Strategic Partnership. 2020-2023
- EOS - Economics of Sustainability: Erasmus+ KA203 Strategic Partnership, 2019 –2022
- HOPPER - HOuseholds' energy Poverty in the EU: PERspectives for research and policies: Erasmus+ Jean Monnet Chair. 2019 –2023

**National research project PNRR, Mission 4, Education, Research**:
- CHANGES (PE5), Cultural Heritage Active Innovation for Sustainable Society.
- RETURN (PE3), Multi-Risk sciEnce for resilienT commUnities undeR a changiNg climate;
- Age-IT (PE8) Ageing Well in an Ageing Society;

DiSEI acts as a leading center for **Projects of Relevant National Interest (PRIN)**, involved in more than 20 research projects, demonstrating a strong commitment across several strategic research areas. Some examples include:
- Environmental sustainability and energy transition:
  - MUST4Water – Multi-scale Modelization toward Socio-ecological Transition for Water Management
  - Solar ENergy Expansion Strategies (ScENES)
  - Climbing the Waste Hierarchy (CLIWEP)
- Innovation, governance, and digital transformation:
  - OPen INnovation in public GOvernance (OPINGOW)
  - Designing a Governance for the Token Economy in a Decentralised Era (ENDORSE)
  - Market Design Architecture and Industrial Policy in the Digital Era.
- Behavioral economics and health decision-making:
  - Game-Based Policies for Blood and Plasma Donation (GAMEDON)
  - Maps of Bounded Rationality, Heuristics, and Nudging in Healthcare Decision-Making
  - "Listen to Me, I Will Respond" (MIRACT).
- Sustainability, circular economy, and production systems:
  - Waste, Sustainability and Innovation in Renaissance Italy (WASTE)
  - Sustainable Food Labels for Product Communication (NEMA Food)

National research projects funded by Ministry of Agricultural, Food and Forest policies
- BEEWIN - BEEkeepers Weather indexed INsurance project
- DIFFER - Diversità, fertilità e resilienza in sistemi agro-zoo-forestali sostenibili

## CONTACTS

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# DEPARTMENT OF LEGAL SCIENCES

www.dsg.unifi.it

The Department of Legal Sciences (DSG) was established in 2013 as part of the pre-existing Faculty of Law.

The Faculty, created in 1924, the year the University was founded, was built on a solid tradition of legal studies that has made a decisive contribution not only to the development of legal science, but also to the life and institutions of the country.

Since their establishment, the Faculty and, subsequently, the Department have interpreted legal thinking in its dual dimension of theoretical knowledge and vehicle for active and informed citizenship.

This dual dimension runs through the pillars on which the Department's activities are based: teaching, research and engagement with society and local territory.

Teaching, as a space for discussion between teachers and students, pays particular attention to innovative teaching experiences which, through a "clinical" approach to the study of legal subjects, allow future lawyers to engage with living law and its practical applications.

The research is conducted by participating in a variety of European, national and local projects that critically examine relevant social, political and economic issues, as well as the historical and theoretical aspects of legal knowledge. Research is also promoted, supported and coordinated by centres and laboratories operating in various fields of law.

Finally, the Department aims to transfer the results of its research outside the academic context, highlighting its practical implications, while also taking on board the ideas and needs of citizens, public and private institutions and the economic system.

The Department of Legal Sciences is therefore an open place that lives with and feeds on the surrounding reality and aims to become a point of reference, development and synthesis for the study and research of law, in its dual theoretical and practical dimensions.

The two Projects of Excellence (2018-22 and 2023-27) for which it has been awarded also reflect this vocation of the Department.

According to the Times Higher Education (THE) World University Rankings by Subject, the Department of Legal Sciences at the University of Florence has improved its position in the field of law year after year. This is a recognition of the quality of research and commitment of our Department members.

## ERC MAIN RELEVANT PANELS

- **SH2 Institutions, Governance and Legal Systems**

## KEY RESEARCH ACTIVITIES

The Department of Legal Sciences (DSG) brings together researchers from many disciplinary areas who carry out their activities in all the different fields of law.

In particular, the DSG Department of Excellence Project 2023-2027, entitled "Excellence and equality: the next generation law(yer)", promotes the role of the DSG as a national and international reference point for research and teaching on tackling inequality and for the implementation of corresponding inclusive actions, also in synergy with third parties, both public and private, including associations and non-profit organisations. The project involves six interconnected thematic areas, all of which are characterised by a high degree of internationalisation:

- welfare systems
- new technologies
- anti-discrimination
- the transformation of civil and criminal justice
- environment and cultural heritage
- business and sustainability

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

Research activities can benefit from a social science library with a holdings of around 900,000 and access to numerous collections and digital resources. These activities are enhanced by 3 research units, 4 centres and 1 laboratory:

- **Beni e Cultura**
- **InsurLab**
- **Osservatorio sulle fonti**
- **Study Centre for the History of Modern Legal Thought (PGM) (1971)**
- **Centro di Ricerca Interuniversitario "CybeRights".**
- **The other right. Inter-university research centre on prison, deviance, marginality and migration governance ADir (2015)**
- **Interdepartmental service centre for research and advanced training on cadaver and forensic identification (TANATOCENTRUM) (2022)**
- **MedICT (Medical and Health Information and Communication Technology) interdepartmental joint laboratory (2022)**

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

**Horizon Europe**
- SONYA (2024-2026) - The role of SOcial ecoNomY in Addressing social exclusion, providing quality jobs and greater sustainability

**Marie Skłodowska-Curie Actions (MSCA) Staff Exchanges 2024**
- EURODEM_WORKSIPG (2026-2029) - Democracy at work in Europe: actors, cultures and models in historical and comparative perspective (1973-2023). Case studies from Germany, Spain, Italy and Portugal in the railway and energy sector.

**Digital Europe Program**
- EUsAIr (2024-2026) - EU Regulatory Sandboxes for Artificial Intelligence

**ERASMUS+ 2021 - 2027**
**Key Actions - KA2**
- **FLEE-ASSET (2024 - 2027)** - Fighting Labour Exploitation through Education - Agricultural Sector Specialist Training

**Jean Monnet Module**
- **GeoConst EU (2024-2027)** - Geopolitics of Constitutions in the European legal space
- **DIGI_DATA yes (2024 - 2026)** - Users' personal DATA, targeting, privacy and contractual consent on DIGItal platforms in EU Private Law
- **SPORTING (2024 - 2026)** - SPORTs law for InclusioN and Growth
- **EVE (2022-2026)** - Exploring Visions of the Environment: EU-Africa mutual learning experiences

Currently, there are also 16 Research Projects of National Interest (PRIN) and 6 PRIN PNRR being conducted in the department.

Further information can be found at the link: https://www.dsg.unifi.it/vp-711-progetti-finanziati.html

## CONTACTS

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# DEPARTMENT OF POLITICAL AND SOCIAL SCIENCES

www.dsps.unifi.it/

The Department of Political and Social Sciences (DSPS) was founded in 2013 and now has 62 members engaged in research, teaching and third mission's activities. The DSPS focuses on contemporary social and political phenomena, and on the analysis of their historical roots and interdependencies.

The DSPS participates in 3 PhD programmes:

1. Social and Political Change, in agreement with the Department of Cultures, Politics and Society of the University of Turin. The administrative seat from 2023 is in Florence;
2. Historical Studies, in agreement with the Department of Humanities and the Department of History, Archaeology, Geography, Fine and Performing Arts of the University of Florence and with the Department of History and Cultural Heritage and the Department of Education, Human Sciences and Intercultural Communication of the University of Siena.
3. Resources for the New Public Administration: People and Data, in cooperation with the Universities of Milano Bicocca, Milano Statale and Ca' Foscari of Venice. This PhD programme is funded by the PNRR and developed in coherence with its objectives.

## ERC MAIN RELEVANT PANELS

- **SH2 Institutions, Governance and Legal Systems**
- **SH3 The Social World and Its Diversity**
- **SH6 The Study of the Human Past**

## KEY RESEARCH ACTIVITIES

Over the last decade, research has been conducted on various themes, including the connections between models of capitalism, welfare, and the effectiveness of democracies at the international level. Other themes include the transformations of inequalities and inclusion policies, the relations between scientific innovation and the development of local economies, humanitarian policies and practices in Mediterranean Europe, good social service practices in the Mediterranean area, communication, media, and the circulation of anti-Semitism, political modernity, processes of globalization, and forms of political coexistence.

Research has been conducted on the political system and the transformations of political representation, policy coherence of local government, links between digital innovation and transformations of procedures in representative assemblies, climate sustainability in public policies, institutional training on new social media, and the relations between generative communication and the differentiation of publics. This text covers various topics including anti-mafia policies and associations as a form of political participation, migration and remittance practices, transnational care practices, the construction of migrant minor identities, reception practices, visibility of the Other in public spaces, the emotional dimension of politics, the history of environmental policies and transformations, and subjectivity in institutional change.

## KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

Library of Social Sciences
Seminar rooms equipped for video-conferences

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

**REPLAN EU** *Implementing Resilience and Recovery Plans in Italy and beyond*
ERASMUS PLUS Jean Monnet module investigating how national recovery and resiliency plans were designed and the extent they are implemented on the ground - PI Prof. Enrico Borghetto.
https://www.dsps.unifi.it/p577.html

**HUMANEUROMED** *Humanitarianism and Mediterranean Europe:*
*a Transnational and Comparative History (1945-1990)*
H2020 ERC Advanced Grant project investigating the role played by Southern European countries in shaping the contemporary regime of international aid - PI Prof. Silvia Salvatici.
https://www.humaneuromed.unifi.it/index.html#

**GLOBAL ANSWER** *Global social work and humAN mobility: comparative studies on local government and good Social Work practices in the EuRo-mediterranean region*
H2020 MSCA RISE project promoting the exchange of knowledge and the transfer of skills and consolidating an international and inter-sectorial network of comparative and collaborative research with training on the identification, analysis and dissemination of good practices in the field of social work and human mobility in Europe - PI Prof. Ivana Acocella.
https://cordis.europa.eu/project/id/872209



**ValEUs - *Research & Education Network on Contestations to EU Foreign Policy***
ERASMUS PLUS Jean Monnet Policy Network, investigating gaps between the European Union's declared values and its foreign policy actions.
- PI Prof. Laura Leonardi.
https://valeus.eu/

*Scaling Solutions: Grassroots–Institutional Synergies for Global Challenges*
FIS3 - The project examines how local initiatives interact with national and supranational institutions in responding to major global challenges. The research develops new analytical tools to understand how often self-organised actions can scale up, collaborate with institutions, and expand their impact. - PI Prof. Giacomo Bazzani

*Development Policies and Digitalization in Italy*
PRIN - Research Projects of National Relevance project - PI Prof. Luigi Burroni

**PROSOCIAL CLIMA** *Prosocial motivations for climate mitigation behaviors*
PRIN - Research Projects of National Relevance project focusing on the analysis of low-carbon behaviors as expressions of prosocial conduct for the benefit of present and future generations. - PI Prof. Giacomo Bazzani
https://www.dsps.unifi.it/vp-631-prosocial-clima.html

**GovREL** *Urban Governance Of Religious Diversity*
PRIN - Research Projects of National Relevance - PI Prof. Marco Bontempi
https://dsps.unifi.it/p625.html

*Explaining the formulation and implementation of Recovery and Resilience Plans in Europe: a comparative approach*
PRIN - Research Projects of National Relevance - PI Prof. Enrico Borghetto
https://www.dsps.unifi.it/p577.html

*Public policies and collective representation for creative work (CREW)*
PRIN - Research Projects of National Relevance - PI Prof. Luigi Burroni
https://www.dsps.unifi.it/p625.html

## Reframing Globalization in European Peripheries: Intellectual and Expert Networks Facing Political and Economic Transformations (1975-2022)

PRIN - Research Projects of National Relevance studying how globalization, democratization, and conflicts intersect in Central and Southeastern Europe since the late Cold War, analyzing transitions shaped by global value chains and liberal-democratic institutions, focusing on intellectual conversations, political cultures, economic strategies, and entrepreneurial networks amidst financial crises and geopolitical shifts driven by Russia and China. - PI Prof. Marco Bresciani
https://dsps.unifi.it/p625.html

## NEWCOMING *New Conflicts' Mapping in the age of Globalization*

PRIN - Research Projects of National Relevance - Recent comparative politics research focuses on cleavages' politicization, noting Rokkanian cleavage decline and the rise of globalization winners and losers. This project aims to understand the political impacts of these shifts, utilizing longitudinal analysis and original data collection methods - PI Prof. Alessandro Chiaramonte
https://www.dsps.unifi.it/p625.html

## Conflict management and resolution in the wider Mediterranean: comparing practices between Western and non-Western actors

PRIN - Research Projects of National Relevance project analyzing how non-Western actors influence conflict management strategies of Western countries in crisis, particularly in the extended Mediterranean region with actors like Russia, China, and Turkey - PI Prof. Stefano Costalli
https://www.dsps.unifi.it/p625.html

## A Gender-Sensitive Inquiry into "Workism" and the Discourses on Professional Duties. Rethinking the Vocabulary of Social and Political Inclusion

PRIN - Research Projects of National Relevance - PI Prof. Dimitri D'Andrea

## Covid-19 as Cultural Trauma. Transformations in Social Solidarity, in Italian Public Opinion and Public Sphere, following the pandemic

PRIN - Research Projects of National Relevance project exploring how the Covid-19 crisis has reshaped social solidarity boundaries in Italy and examining how the pandemic has fostered inclusive solidarity, transforming disruptive events into resources for strengthening societal unity - PI Prof. Laura Leonardi
https://dsps.unifi.it/p625.html

## KEYS *Knowledge and Experts in the policY of Sustainable development*

PRIN - Research Projects of National Relevance - PI Prof. Andrea Lippi

## Loyalty Allegiance Consensus. Europe and Spanish Colonies in 18th century

PRIN - Research Projects of National Relevance analyzing 18th-century succession crises, focusing on new loyalty, obedience and political partnership practices, and administrative models - PI Prof. Luca Mannori
https://dsps.unifi.it/p625.html

## Politics under commission. How special procedures change democracy

PRIN - Research Projects of National Relevance - PI Prof. Vittorio Mete
https://dsps.unifi.it/p625.html

## The legislation on psychotropic substances, especially 'soft drugs': an interdisciplinary analysis from a criminal law, criminological, statistic and economic point of view and reform perspectives

PRIN - Research Projects of National Relevance project examining cannabis legalization and its potential benefits starting with an analysis of the costs of prohibitionism on the criminal and social systems. - PI Prof. Vincenzo Scalia
https://dsps.unifi.it/p625.html

## Social Transformations and the Crisis of Expertise

PRIN - Research Projects of National Relevance project investigating the crisis of expertise in advanced societies, focusing on the Covid-19 pandemic, examining the challenges in communicating medical knowledge to the public and aiming to revise expert mediation practices in healthcare while exploring broader issues of credibility and expert knowledge mediation - PI Prof. Laura Solito
https://dsps.unifi.it/p625.html

## CONTACTS

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# DEPARTMENT OF ARCHITECTURE

www.dida.unifi.it

Research and educational activities at the Department of Architecture (DiDA) are organised into several disciplinary components: architectural design, representation, history of architecture, conservation and restoration, building science and technology, architectural technology, estimation and valuation, industrial design, fashion design, urban design and spatial planning, and landscape design.

DiDA's main mission is to promote culture and science through projects, with a lear focus on all aspects of architecture, design fashion, urban planning and landscape. This dimension is called upon to confront the complexity of nowadays economic and social changes, the new scenarios opened up by the globalisation of production processes, and the innovations introduced in communication systems. This requires a cultural approach and research methodologies in which critical and interpretative abilities are integrated with a broad spectrum of technical and design skills, capable of directing the transformations of physical space and the related design and production processes towards forms of sustainable and conscious development, to improve the quality of life of all mankind and the environment.

## ERC MAIN RELEVANT PANELS

- **SH5 Cultures and Cultural Production** [SH5_4, SH5_6, SH5_7, SH5_8]
- **SH7 Human Mobility, Environment, and Space** [SH7_4, SH7_5, SH7_6, SH7_7, SH7_8]
- **PE8 Products and Processes Engineering** [PE8_3, PE8_10, PE8_11]
- **PE10 Earth System Science** [PE10_4]

## KEY RESEARCH ACTIVITIES

DiDA's research activities embrace all scales and declinations (cultural, creative, technical and technological) of spatial analysis and design, as well as the different declinations with specific attention to human activities' environmental, social and economic impacts. DiDA's initiatives address all 17 Sustainable Development Goals (SDGs) outlined in the United Nations 2030 Agenda, either directly or through related themes. The following SDGs are particularly central to DiDA's mission: 3. Good health and well-being; 4. Quality education; 6. Clean water and sanitation; 7. Affordable and clean energy; 9. Industry, innovation and infrastructure; 10. Reduced inequalities; 11. Sustainable cities and communities; 12. Responsible consumption and production; 13. Climate action; and 17. Partnerships for the Goals.

## KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

DiDALabs serve as a research support infrastructure designed to overcome the sectorialisation of knowledge by fostering both established and experimental forms of transversality and intersectoriality, unified by the project's thematic focus across all scales. DiDALabs are divided into two groups: Service Laboratories (LASER) and Research Laboratories (LARI).

The LASERs are structures of the DiDA, they carry out activities and support research and offer direct and onerous services to users inside and outside the DiDA. LASERs are characterised by the presence of machines and/or machinery (including non-transportable) instruments, devices and special equipment designed to guarantee

specialised services and high-performance scientific services "on demand" by students, professors, researchers or external users.
LASERs include: Communication; Informatics and Bim; Models for Architecture and Design; Self-construction; Extended Reality; Photo and Video; Building Technologies; Materials and Structures Testing; Architectural surveys; Restoration; Technologies for Mediterranean Living.
In LARIs is carried out and promoted scientific research and the transfer of knowledge from research to institutions, territories and society.
In addition to DiDALabs, DiDA implements research through ten Research Units and the two Inter-University Research Centres TESIS - Systems and Technologies for Social, Health and Education Facilities and ABITA - Bioecological Architecture and Technological Innovation for the Environment.

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

Recently international funded projects include:
- **VeNiss** - Venice's Nissology Reframing the Lagoon City as an Archipelago: A Model for Spatial and Temporal Urban Analysis (HE-ERC);
- **INSIDE-ACT** - an unconventional and interdisciplinary training among design, art, pshychology and digital for shaping a new immersive storytelling designer (ERASMUS+ - Alliances for Education and Enterprises);
- **CivicHype EU** - Youth Engage, Debate, Influence, Connect (CERV - Citizenship, Equality, Rights and Values programme);
- **HEPHAESTUS** - HEritage Protocols for ArcHitecturAl European croSs-bordering siTes evalUationS (HE - MSCA);
- **IDEAL** - Innovation-Driven Entrepreneurship and Academic Learning for creative industries (HE - EIC Pathfinder);
- **R-evolve** - Roll out Systemic Change to evolve the Furniture Industry towards CE through the Implementation of innovative Circular Business Models, Material & Design Strategies, and the Digital Product Passport (HE - CL6);
- **NATURGO** - Nature Based Solutions and Urban Governance (DUT - Driving Urban Transitions)
- **Partnership Establishing a New Minor Degree Program in Conservation and Heritage Preservation at Northern Technical University in Mosul, Iraq** (UNESCO - CFP);
- **AqUAlive** - Aquatic Urban ecosystems Alive (DUT - Driving Urban Transitions);
- **UrbanElemenTREE** - Data-driven approach and management platforms as the basis for the smart development of the urban tree canopy (DUT - Driving Urban Transitions);

Recently national funded projects include:
- **PERSONA** - Personalized Comfort Models for Enhanced Environmental Control in Building Dynamic Simulation (MUR - FIS)
- **ARMCV** - Studi e ricerche sullo stato di conservazione e di consistenza delle strutture del Museo di Casa Vasari di competenza della DRM Toscana, ai fini dell'identificazione di scelte progettuali per il restauro del complesso Ministero della Cultura - (Direzione Regionale Musei della Toscana)
- **SENSLIFE** - SENSor systems for smart monitoring through LIFE protection devices on civil constructions (MUR - FISA)

**CONTACTS**

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# DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

www.dicea.unifi.it



The Department of Civil and Environmental Engineering (DICEA) carries out basic and applied research, teaching, cultural and technological transfer, and public engagement activities in the fields of water and environment management, including reuse and recovery of resources, geomatics and infrastructures, geotechnics, structures, and architectural and building engineering. The disciplines characterizing the Department are hydraulics, hydrology, hydraulic and maritime constructions, sanitary and environmental engineering, transport engineering, geomatics, soil mechanics and geotechnical engineering, solid and structural mechanics, structural analysis and design, construction technology, technical architecture, and urban planning. The integration of these disciplines is a key part of the Department's mission aimed at promoting the sustainable development of safe and resilient human communities and ecosystems. The Department is composed of 40 Professors (Full and Associate), 13 Assistant Professors, 23 Post docs, more than 50 PhD students enrolled in the Department's International Doctorate in Civil and Environmental Engineering program, and the administrative and technical staff.

The Department is organized into four main divisions: Water and Environment, Geomatics and Infrastructures, Geotechnics, and Structural, Architectural and Building Engineering.

Water and Environment

The Water and Environment research unit is actively involved in the fields of Fluid Mechanics, Hydrology, Marine and Coastal Dynamics, Climate Change and Sustainable Development, Water Engineering and Environmental Systems, Treatment Processes and Environmental Biotechnologies. The main research activities include the management of water and energy resources, the assessment and mitigation of hydraulic risk, the design and management of processes and of hydraulic risk, the design and management of processes and systems for environmental protection, the reuse and recovery of resources, the field of hydraulic and maritime constructions and the protection of the coasts, the dynamics of the global water and energy cycles, the impact of climate change on socio-environmental systems, and the influence of land feedbacks on climate and climate extremes.
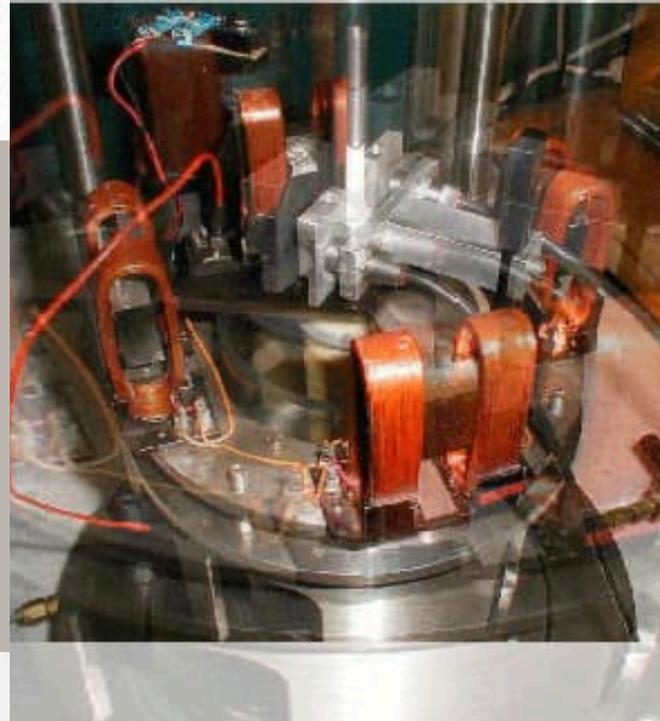
## ERC MAIN RELEVANT PANELS

- **PE8 Products and Processes Engineering**
  - PE8_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics
  - PE8_4 Computational engineering
  - PE8_5 Fluid mechanics
  - PE8_6 Energy processes engineering
  - PE8_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage
  - PE8_14 Automotive and rail engineering; multi-/inter modal transport engineering
- **PE3 Condensed Matter Physics** [PE3_14]
- **PE5 Synthetic Chemistry and Materials** [PE5_1 ]
- **PE6 Computer Science and Informatics** [PE6_11, PE6_12]
- **LS9 Biotechnology and Biosystems Engineering** [LS9_7]
- **PE10 Earth System Science** [PE10_2, PE10_3, PE10_12, PE10_14, PE10_17, PE10_20]
- **SH4 The Human Mind and Its Complexity** [SH4_5]
- **SH7 Human Mobility, Environment, and Space** [SH7_6, SH7_9, SH7_10]

The staff share an interdisciplinary approach to research and to teaching and a strong involvement into international research networks and projects and the unit is open to contributions from other disciplinary scientific sectors with the potential of synergistically contributing in the fields of the management of resources and urban systems, the protection of the environment, the monitoring and control of pollution phenomena, from planetary scale of climate change to the nano scale of biological processes.

## Geomatics and Infrastructures

The Geomatics and Infrastructures unit deals with all the aspects of road safety, from the road design to the development of accident prediction models. Analysis of safety barriers behaviour with FEM tools and analysis of the influence of Human Factors in road safety by studying the driver behaviour through a dynamic driver simulator. Evaluation of the impact of autonomous vehicles in transportation and how to better improve their inclusion on the current road systems. Planning instruments to help citizens moving in cities. Several projects and activities in the Department are related to geospatial data acquisition, modelling and processing, by using static and dynamic platforms, terrestrial, aerial and marine, exploiting a wide range of sensors (RGB, multispectral and thermal cameras, laser scanners, radar, echo-sounder) and techniques (terrestrial and mobile laser scanning, photogrammetry). Spatial data processing, information extraction and data analysis is performed by using geographic information systems and ad hoc developed tools, based on artificial intelligence methods, e.g. deep learning-based analysis of 2D and 3D data. 3D modelling with BIMs, virtual reality and 3D printing are also exploited, in particular related to cultural heritage applications. Positioning and navigation in critical environments is also an active research field, mostly to support autonomous driving.

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## Geotechnics

The research activities of the geotechnical team are related mainly to: (1) analytical, computational and experimental methods for the linear and nonlinear analysis of soil behaviour; (2) evaluation of seismic ground motion for structural design purposes and seismic site stability analysis; (2) analysis of the static and seismic behaviour of building foundations, and artificial and natural slopes; (3) assessment and mitigation of seismic geotechnical hazards such as local amplification of ground motion; soil liquefaction, soil settlements, and landslides; (4) environmental and sustainable geotechnics, with special emphasis to energy micropiles and on the analysis and climate-adaptive geotechnical mitigation of environmental risks from natural and anthropogenic hazards; and (3)application of advanced non-deterministic methods in the management and analysis of geotechnical data and in the application of statistical, probabilistic, and machine learning algorithms to the multi risk zonation of geotechnical hazards. Starting in the fall of 2023, the geotechnical team will play a central role in a 4-year Horizon Europe project focusing on the sustainable remediation and restoration of soil in polluted and unstable sites, operating specifically in the quantitative modelling of soil resilience and on the risk mitigation effects of geotechnical nature-based solutions. The unit is equipped with a Laboratory for soil testing under both static and dynamic loading conditions.

## Structural, Architectural and Building Engineering

The Structural, Architectural and Building Engineering group focuses on solid and structural mechanics, structural analysis and design, architectural and building engineering. The most active research areas in these fields are: analytical, computational and experimental methods for the linear and nonlinear analysis of traditional and innovative materials; structural analysis, identification and monitoring of historical buildings, Structural Health Monitoring of existing buildings and structures; earthquake engineering, structural rehabilitation and advanced seismic protection technologies; sustainable materials for structural use and engineering of natural materials; structural dynamics and fluid structure interaction problems with a focus on wind engineering and offshore wind energy structures; energy and environmental sustainability at both urban and building levels: identification of energy and environmental strategies and technological solutions to achieve low-carbon buildings in a life cycle perspective; analysis and redevelopment of the modern building heritage; critical analysis of representative case studies starting with the interpretation of design and construction processes. The unit is equipped with a Laboratory for Structural and Material Testing and a Boundary Layer Wind Tunnel (see descriptions below).

# KEY RESEARCH ACTIVITIES

WATER AND ENVIRONMENT
- Fluvial and lagoon hydro-morphodynamics; sedimenttransport; river engineering.
- Fluid-dynamical modeling. Physically-based stochasticmodels of rainfall. Distributed hydrologic modeling for real time flood forecasting. Use of Quantitative PrecipitationForecast in flood risk management. Management and design of multi-sensor hydro-meteorologic data networks. Watershed planning. Sustainable water supply in aridregions. Climate change impacts on eco-hydrology and water resources.
- Natural disturbances in forest ecosystems under present and future climate conditions, climate-related tipping points in terrestrial ecosystems, socioeconomic vulnerability to climate extremes, land-atmosphere interactions and water-carbon coupling, modeling the impact of artificial reservoirs on precipitation, development of early warning systems of critical transitions in forest ecosystems.
- Coastal Dynamics, Marine Renewable Energies.
- Water-energy-food nexus and water related ecosystemsservices. Hydraulic structures and hydraulic risk analyses.
- Characterisation and treatment of waste, wastewater andgaseous streams, bioeconomy and resource recovery from wastewater and waste, modelling and control of engineered microbial communities for wastewater treatment and resources recovery. Wastewater reclamation and reuse foragricultural and industrial purposes, carbon footprint analysis and energy optimisation of wastewater treatment plants.

GEOTECHNICS
- Characterization of soils under static and dynamic loading conditions.
- Seismic ground response.
- Seismic liquefaction.
- Slope stability.
- Seismic microzonation.
- Soil-structure interaction.
- Programming of software for geotechnical analyses.
- Non-deterministic methods for geotechnical characterizationand design.
- Geotechnical mitigation of environmental risks.
- Analysis and design of geotechnical nature-based solutions.
- Geotechnical multi-risk analysis and zonation.

STRUCTURAL, ARCHITECTURAL AND BUILDING ENGINEERING
- Methods in Computational Mechanics for linear and  nonlinear problems.
- Nonlinear constitutive equations and models for existing and innovative materials, including masonry-like materials.
- Theoretical, experimental and computational methods for smart materials and structures
- Responsive and environment-sensitive materials, morphing devices and structures
- Static and dynamic behavior, identification and reinforcement of masonry structures and wooden elements.
- Earthquake engineering, seismic risk analysis and  vulnerability of masonry historical buildings.
- Modeling and design of advanced seismic protection technologies.
- Data-driven methods, structural monitoring and damage detection.
- 3D printing of earth based materials.
- Mechanical performances of non-standardized structural materials.
- Bridge and Bluff-body aerodynamics.
- Wind loads on large structures and wind-induced vibrations  of slender structures.
- Experimental aerodynamics.
- Offshore fixed-bottom and floating wind energy structures.
- Waves-structure interaction.
- Energy and environmental sustainability at urban and building levels.
- Green infrastructures in urban districts to tackle climate change.
- GIS and BIM tools to perform multidisciplinary analysis.
- Methodologies for preservation and sustainable retrofitting of modern building heritage.

GEOMATICS AND INFRASTRUCTURES
- Risk analysis.
- Development of crash prediction models.
- FEM evaluations for safety barriers.
- Definition of procedures for the evaluation of road safety on existing roads.
- Infrastructure digitalization to improve road safety.
- Conception and management of new modes of transport (HS and I2V communications) for the safety and fluidity of circulation.
- Cultural heritage documentation and modelling.
- Digital and physical twins.
- Plastic/litter detection in the fluvial/marine environment.
- Semantic segmentation and modelling of point clouds.
- Landslide monitoring.
- Road traffic monitoring.
- Precision agriculture, advantages and risks related to terraced vineyards.
- Remote sensing based environmental monitoring.
- Remote sensing and drone-based bathymetry.
- Remote sensing satellite-based RADAR SAR images analysis.
- Collaborative positioning and navigation.

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

WATER AND ENVIRONMENT
- LABIMA (Maritime Engineering Laboratory)
- LDT (Geographical and Environmental Information System integration lab)
- Spatial Data Laboratory: reference lab for spatial and environmental data processing with Geographic InformationSystems (GIS)
- River Hydraulics, lagoon and biofluidodinamics laboratory
- Sanitary and Environmental Engineering Lab
- The following laboratories are managed jointly with industrial partners and external institutions, including other departments of the University of Florence:
- Water, sea, environment energy – (A-MARE)
- Research center for tannery wastewater (Cer2co)
- UNALAB (wastewater treatment processes)
- LIROMAN (monitoring of environmental pollution)
- WASTEREC (recovery of resources from industrial wastewater)

GEOMATICS AND INFRASTRUCTURES
- Dynamic driving simulator to evaluate driver behaviour;
- Eye-tracker device that allows the analysis of the most attractive elements in the driver and pedestrian field of view;
- Automated bus to improve transportation efficiency and evaluate the integration of automated vehicle in the current road network.
- Fleet of Unmanned Aerial Vehicles (UAV), ranging from mini UAV to quite large ones, enabled to mount different types of sensors, such as RGB, multi-spectral and thermal cameras, LiDAR.
- Terrestrial topographic survey equipment: Terrestrial/mobile laser scanners, GNSS receivers, total stations.
- Digital cameras and workstations for aerial and close range photogrammetry.
- Virtual reality headsets.

GEOTECHNICS
- Extensive database containing the results of in situ and laboratory tests performed by the Geotechnical Laboratory of DICEA to measure the dynamic properties of soils from several areas in central Italy is available.
- Further equipment for laboratory and in situ test will be made available by a REsearch Center for GEOtechnicalcharacterization and modelling (RECGEO) leaded jointly by DICEA-UNIFI and DST-UNIFI.
- Two 30 m deep boreholes, arranged for geophysical tests, are available in the park of the Engineering School.

- Standard and advanced equipment for carrying out laboratory testing on soils under static and dynamic loading conditions, and for performing in-situ static and dynamic tests. Specifically, equipment for performing laboratory tests under static conditions includes:
    - tools for soil classification and compaction tests;
    - ooedometer devices;
    - Casagrande shear box;
    - triaxial devices equipped for external and internal strain measures;
    - standard and modified Proctor test equipment;
    - in-situ density measurement device.
- Equipment for measurement of soil dynamic properties includes:
    - resonantcolumn and cyclic torsional shear device;
    - cyclic triaxial test apparatus;
    - equipment to perform in situ static and dynamic tests, i.e.: density tests, static plate load tests and down-hole tests.

STRUCTURAL, ARCHITECTURAL AND BUILDING ENGINEERING
- Laboratory for Structural and Material Testing: Thelaboratory has all instruments needed to measure forces, displacements, strains, accelerations, and is equipped with the following main testing machines:
    - Static loading system: A combination of steel frames (one horizontal frame and two vertical frames) and hydraulic  actuators enables loading tests to reproduce the state of  stress and deformation in structural elements and  connections, under both vertical and horizontal load  (monotonic or cyclic).
    - S500 kN Structural Testing Machine (MTS 321-21): This machine can apply both compression and tension load up to a maximum of 500 kN. Differently from the static loading system, this machine allows for tests to be performed directly without assembling loading frames;
    - Universal testing machine (INSTRON 4486): Electromechanical system to perform static testing, including tensile, compression, bend, peel, tear, shear, friction, puncture, and other mechanical tests. Capacity: 300 kN;
    - Compression Testing Machine (CONTROLS): This machine can apply compression load for uniaxial compression tests(concrete, bricks, or stone specimens).
    - Vibrodyne: Electro-mechanical excitation machine (used in dynamic tests of existing structures) that can generatevibrations, with known frequency and amplitude; it produces unidirectional harmonic forces with variable intensity sinusoidal laws.
    - Boundary Layer Wind Tunnel:
    - Open-circuit (Eiffel-type) wind tunnel with a 10 m-long closed test chamber.
    - Test section 2.4 x 1.6 m2
    - Wind velocity continuously variable between 0 and 31 m/s.
    - Residual turbulence (in the absence of turbulence generating device)
    - Two main test sections for Boundary Layer (with remotely controlled turntable) and Aerodynamic/Aeroelastic testtypologies.
    - Anemometric dynamical measurements of flow velocity:Pitot tubes + Setra pressure transducers for mean flow velocity; single and multi-components (2 and 3 wires) hot wire anemometers for 3D turbulence characteristics.
    - Robotic arm constituting the traversing system for flowmapping in different sections of the chamber.
    - Piezoelectric and estensimetric 6-components (3 shearforces + 3 moments | X-Y-Z) force measurements.
    - Displacements and Accelerations by means of leasersensors and miniaturized accelerometers.
    - Dynamical pressure fields measurements with miniaturizedpressure scanners (190 simultaneous taps up to 650 Hz). - Automatically controlled test-rig for aerodynamic forces,varying angle of attack.
    - 2-DoF Aeroelastic setup, for small and largedisplacements/rotations of sectional models.

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

A list of the projects the Departments was/is involved in
can be found here:
www.dicea.unifi.it/vp-629-catalogo-progetti-di-ricerca.html

# DEPARTMENT OF INFORMATION ENGINEERING

www.dinfo.unifi.it

The Department of Information Engineering (DINFO), one of the 21 departments of the University of Florence, is the reference Department for ICT (Information and Communications Technology), where it carries out advanced research in control systems, computer science and engineering, electronics systems, electromagnetism, telecommunications, operation research, bioengineering and electrical engineering. Traditional and advanced research, design and implementation focus on digital signal processing, fixed and wireless telecommunications systems, radar, sensors and electronic devices, advanced software, ultrasound systems, satellite telecommunication, localization, and sensing, media content processing and interpretation, decision support, security and protection of information and telematics, ICT for eHealth systems and electrical networks efficiency, measurement, reliability and safety.

## ERC MAIN RELEVANT PANELS

- **PE6 Computer Science and Informatics**
- **PE7 Systems and Communication Engineering**

DINFO is member of several inter-university centres and consortia, among which CNIT (National Inter-University Consortium for Telecommunications), CNIT (National Inter-University Consortium for Telecommunications), CINI (National Inter-University Consortium for Informatics), MECSA (Microwave Engineering Centre for Space Applications), MIDRA (Multidisciplinary Institute for Development Research and Applications) and TICOM (Consortium for Technologies of Information and Telecommunications), which play an important role in the national high-level scientific cooperation between universities and industries.

DINFO includes MICC (Media Integration and Communication Centre), a centre of excellence established by the Italian Ministry of University and Research in 2001. DINFO also includes CITMQSA (Inter-Department Center for Microsystem Technologies for Environmental Quality and Safety).

DINFO employs a workforce of more than 210 units (including professors, researchers, technical and administrative people, post-doc fellows and PhD students) with success in the acquisition of important public and private research funding. DINFO is in charge of three first-level three-year degree courses (Electronics Engineering; Informatics Engineering; Biomedical Engineering in collaboration with DIEF), five Master-of-Science two-year courses (Electronics Systems Engineering; Robotics, Automation, and Electrical Engineering, in collaboration with DIEF; Biomedical Engineering, in collaboration with DIEF; Informatics Engineering; Artificial Intelligence) and three PhD programs (Information Engineering; Smart Computing, in collaboration with the Universities of Pisa and Siena; Smart Industry, also in collaboration with the Universities of Pisa and Siena) for a total of about 1,400 students.

The main public research funding comes from the European Community, the European Space Agency, the Ministry of University and Research, national research programs and the Tuscany Region. More than a quarter of the research budget of the DINFO comes from contracts with private companies that generate a fruitful technological transfer to industry.

# KEY RESEARCH ACTIVITIES

The Department of Information Engineering offers an ecosystem of disciplines dealing with information at different levels:

### Electronics and Electromagnetism
Microelectronic systems, ultrasonic, microwave RF and electromagnetism, radar systems, microelectronics, programmable devices, wireless systems, numerical methods, antenna systems

### Electrical Engineering, Measurements, Reliability and Safety
Power systems, reliability, metrology, electromagnetic compatibility, smart-grid, electrical and electronic measurements, maintenance, fault diagnosis, risks and functional safety

### Telecommunications
Signal and radar processing, communication networks, Internet of Things, vehicular communications, satellite communications,quantum networks, software-defined networks, blockchain

### Control, Automation, and Optimization
Global optimization; robust and nonlinear control, cyberphysical systems, adaptive and learning systems, sensor networks, intelligent autonomous systems, large-scale systems and big data, data fusion

### Computer Science and Networking
Distributed systems, big data, software engineering, software architectures, stochastic models, performance and dependability evaluation, IoT, intelligent networking, network and security

### Artificial Intelligence and Computer Vision
Machine learning, deep learning, computer vision, pattern recognition, multimedia, human computer interaction, data mining, natural language processing, 3D graphics

### Bio-Engineering
BioSystems, BioSignals and BioImaging; artificial intelligence and pattern recognition, biostatistics

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

The Department of Information Engineering consists of a network of laboratories working on specific research topics. All laboratories can support research activities with specific instrumentation.

**Automation and Control**
- Systems & Control Lab

**Electronics and bioengineering**
- Biomedical Engineering Lab
- Microelectronics Systems Design Lab
- Electronic Systems for Environment and Cultural Heritage Lab
- Ultrasound and Non-Destructive Testing Lab

**Informatics Engineering and Optimization**
- Artificial Intelligence Lab "Giovanni Soda"
- Distributed Systems and Internet Technologies Lab
- Global Optimization Lab "Gerardo Poggiali"
- Software Technologies Lab
- MICC Media Integration and Communication Center

**Electromagnetic Engineering and High-Frequency Systems**
- Radar and Millimeter Waves
- RF, Microwaves and Electromagnetics lab

**Electrical Engineering and Measurements**
- Electromagnetic Compatibility Lab
- Measurement, Reliability, and Safety Lab
- Power Electronics Lab
- Electrical Energy Engineering Lab

**Telecommunications and Networks**
- Data Communications Networks and Systems Lab
- Signal Processing and Communications Lab

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

A brief list of the most recent projects (2020-2025) is summarized below:

## European Research Projects
- Cardiovascular Ultrasonic Applications
- A Participative Assistive AI-powered Tool for Supporting Trustworthy Online Activity of Citizens and Debunking Disinformation
- Innovative Sensor Integration for Remote Landmine Detection
- On the UsE of Internet of Senses for the CuLturaL HerItagE
- Tuscany EU Digital Innovation Hub
- TOURism Innovative and Sustainable Management of flOws
- Exploratory approach for Digital Wellbeing social impact assessment among adult population in Europe
- Leveraging AI based technology to transform the future of health care delivery in Leading Hospitals in Europe
- Multi-sensor cooperative robots for shallow buried explosive threat detection
- Uncovering media manipulation chains through container and content detectable traces
- Ultrasonic Acquisition System
- Redefining the future of cultural heritage, through a disruptive model of sustainability
- sAfe Urban aiR mObility for euRopeAn citizens

## National Research Projects
- Algorithms for cbct image improvement
- Pubblicazione FUP "Adriano Olivetti: una complessità virtuosa"
- "L'ingegnere umanista: ricerca qualitativa sui curricula accademici degli ingegneri e divari rispetto alle esigenze delle imprese."
- Modelling elettromagnetico di irregolarità su superfici
- Bluetooth communication system enabling bridging to IP networks with indoor localization capability without calibration
- Radar aboard Unmanned Aerial System (UAS) for detecting Foreign Object Debris (FOD) on runways and taxiways of commercial Airports
- Active magnetic bearing controller design automation for turbomachinery
- Sviluppo del registro italiano delle cefalee (Studio RICe)
- Satelliti corotanti per la stima del vapore acqueo in troposfera SATCROSS
- Sviluppo laboratorio per la ricerca e lo sviluppo di tecniche PQ SELAB-21
- Sistema automatico multimodale per la rilevazione delle crisi epilettiche in terapia intensiva neonatale
- Elaborazione e classificazione di segnali biomedici: applicazione alla diagnosi e terapia di disturbi neurologici in neonati, bambini e adulti
- Pattern and Anomaly Discovery - Terranova
- Ecosistema uRbano per l'invecchiaMEnto attivo e in Salute
- Studio e sviluppo di radar interferometrici
- Forensic methods for image and video integrity verification
- Sviluppo di dispositivi e sistemi innovativi per la gestione, la conversione e lo storage di energia
- Conic Open scanNEr for UltraSound research advancement
- Resilient Optimization in Distributed Cyber-Physical Control Problems subject to Adversarial Behaviour
- SensoriMotor Assessment of digital Capacity and aCcessibility (SMACC)
- Simultaneous Wireless Information and Power Transfer Assisted by V-band Active Reflective Intelligent Surfaces for Industrial Software Defined Network of Internet of Things (SIPT-VARIS)
- Measuring tropospheric water vapour through the Normalized Differential Spectral Attenuation (NDSA) technique
- Smart Hybrid Energy Storage Systems for Renewable Energy Communities - SHESS4REC
- Computational Methods for Third Generation Cancer Genomics
- ASTRA: Autonomous unmanned aerial System for synThetic aperture Radar, photogrAmmetry and digital image correlation
- ADVENTURE (ADVancEd iNtegraTed evalUation of Railway systEms)
- Circular models for Italian fashion heritage and manufactures through digital inclusivity and conscious innovation
- Modeling and Optimization of Smart Technologies forBuilding Integrated Photovoltaics - MOST4BIPV

**Regional Research Projects**

- AISS - AI based Service management Suite
- GENHAPI - GENerative Human API for prompt integration
- SPARCLI - Technological development and implementation of an integrated digital platform
- Smart Food Supply Chain - A digital platform for an intelligent, sustainable, and transparent food supply chain
- SADI MIAC - Sistema di Assistenza alle Decisioni Integrato con Modelli Digital Twin e Intelligenza Artificiale per le attività commerciali
- TALIA - Tuscany AI-based pLatform for Integration and Analysis of oncological clinical
- WEWAIR - WEather and Wind monitoring using AI-driven Radar systems
- Ispezione remota per apparati industriali e aziende manifatturiere
- REWIRE - Remote WIldlife monitoring in Real-Time
- ANDROMEDA - Tecnologie e metodi di ingegneria del software per architetture a microservizi a supporto della gestione di filiere di produzione
- TAAS Ticketing as a Service
- E-EARTH
- STELLA - Sistema inTEgrato per Lo studio del contenuto d'acqua in agricoLturA
- AMPERE - Arte, Moda e arredo in un Processo Elettrochimico innovativo con controllo da Remoto 4.0 - circular Ecofriendly
- INSIDERAIN - INStruments for Intelligent Detection and Estimation of Rain for Agricultural Innovation
- SUCC&SS - Sviluppo di unità intelligenti in ottica industria 4.0 ad alta sicurezza ed affidabilità per la gestione e l'intercettazione della CO2 gassosa e liquida per futuri impieghi in ambito di progetti "Carbon Capture & Storage"
- RIBAT - Riciclo Integrato Batterie AutoTrazione
- DI-ASD - Sistema Per Il Supporto Alla Pratica Clinica Per La Valutazione Ed Il Monitoraggio Dei Disturbi Dello Spettro Autistico In Fase Diagnostica
- QUASAR QUantitative Analysis for Services and Assets Reliability (Regione Toscana)
- SCHEMA Supply CHain Evaluation with Model-based & data driven Approaches (Regione Toscana)

**CONTACTS**

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# DEPARTMENT OF INDUSTRIAL ENGINEERING

www.dief.unifi.it

The Department of Industrial Engineering (DIEF) is distinguished by research in an international context with participation in competitive projects (particularly EU) in different areas of engineering and in partnerships including high-level industrial and research realities. The vocation to support the industrial environment through technology transfer is also relevant, as demonstrated by DIEF's annual budget, which, despite its small size (only 60 staff faculty/researchers), counts about 8 M€ of revenue in 2021/2022, (45% from EU funding and more than 30% from industrial research contracts)

Research topics range from Industry 4.0, integrated with design sustainability, to standard industrial design processes, production and management. Particularly relevant are the research in the different fields of sustainable mobility, the development of renewable energy and hydrogen production and use, the development of methodologies and devices for marine or biomedical applications up to the study of innovative materials. Common to all the cited topics is the development of mathematical/numerical engineering models for the simulation of machines and engineering systems.

## ERC MAIN RELEVANT PANELS

- **PE1 Mathematics** [PE1_18, PE1_19, PE1_22]
- **PE8 Products and Processes Engineering** [PE8_1, PE8_5, PE8_7, PE8_8, PE8_9, PE8_10]
- **PE11 Materials Engineering**

DIEF is highly committed to multidisciplinary activities, with the engineering area being supported by the mathematics, addressed to the study of numerical tools for simulation and of data-driven models, and by chemistry, for the research on innovative materials and their treatments.

One of DIEF's greatest strengths, is the large number of research and technology transfer projects that have involved its staff. With reference to the last 10 years, DIEF has coordinated or was a partner in:

Over 50 EU Projects (Horizon Europe, H2020, FP7, Life and others);

More than 15 National Projects (PRIN, FIRB, MISE, MUR);

Over 45 Regional Projects (POR-FESR and others);

In addition, over the past 5 years, there have been about 100 research agreements with leading Italian and European companies such as Enel Energia, GE Aviation, Avio Aero, Ferrari, Yanmar, Toyota, INAIL, Magneti Marelli, FCA, Baker Hughes, Ducati, Hitachi Rail, Ansaldo Energia, Meyer Children's Hospital, ADLER PEZLER, McPhy, Piaggio, SOL.

# KEY RESEARCH ACTIVITIES

**Eco-sustainable design and management and circular economy**
Circular Economy in typical Made in Italy production sectors; Ecodesign and Life Cycle Assessment; Eco-sustainable treatments for pharmaceuticals, textiles and fashion; Optimization and efficiency methods for industrial and hospital processes; Lean Manufacturing.

**Product and process design and optimization**
Methods and tools for product and process optimization and control; Product certification, real-time diagnostics and blockchain; Systematic design methods and design for Additive Manufacturing (A.M.) /usability/assembly/disassembly/recycling; Predictive models for smart and sustainable design and manufacturing; Robotics Manufacturing and demanufacturing using robotic systems; Social robotics for rehabilitation and surgery;
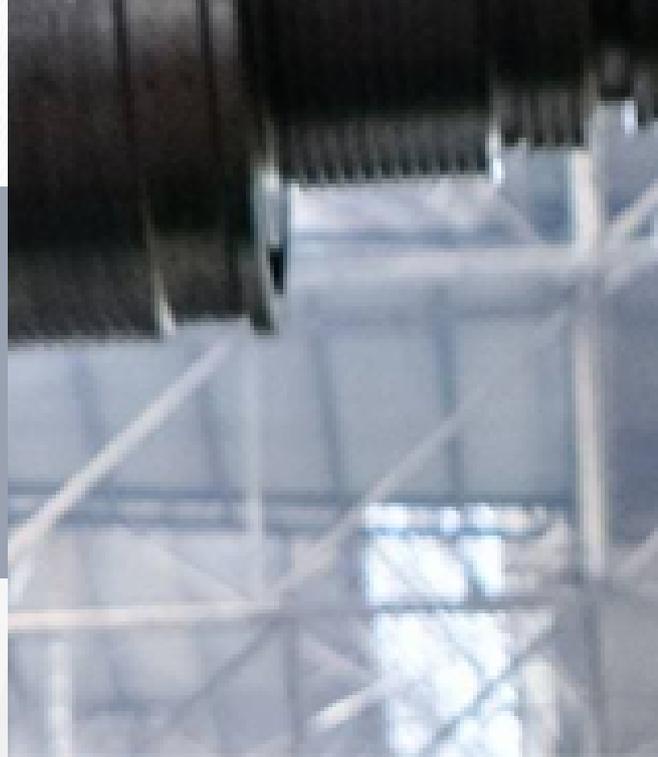
Robotics for marine monitoring and intervention.
- Microstructural evolution of the WAAM process
- The use of WAAM technology for cladding and repair of ferrous and non-ferrous alloys
- Study of deposition strategies and arc oscillation to improve the microstructure and deposition accuracy
- Modeling and optimization of machining processes (turning, milling)
- Smart devices for monitoring and control of machining operations
- Sustainability assessment and optimization of machining processes
- Advanced manufacturing approaches for aerospace components

**Enabling Technologies Industry 4.0**

Optimization of production lines using Industry 4.0; Innovative A.M. technologies; Digital Twin, Augmented Reality and process and product simulations; Information generation, storage and synthesis of data obtained from primary sources.

**Safety and improvement of the environment, workplaces and mobility**

Noise mitigation including through active control methods; Human-machine interfaces for production, safety and worker involvement; Traffic accident reconstruction and analysis; Development of personal protective and safety devices for two-wheeled vehicles.

**Innovative Materials**

Innovative materials of natural origin; Supramolecular and nanostructured systems for the analysis of pollutants; Design of materials for catalytic applications; Sensors for the determination of chemical and microbiological contamination; Innovative materials for the textile, fashion, and agri-food sectors.

- Solid state research focused on structural/electronical/morphological/ thermal properties aiming at understanding connections between structure and physicochemical properties (including stability) in materials (often organics). A joint experimental and in silico approach is used for their characterization, analysis, and study including crystallography, thermoanalytical and thermomicroscopic techniques.
- Development and characterization of nanostructured magnetic materials and oxides.
- Development of magnets without Rare Earth elements
- Production of coatings with metals, alloys, and oxides by PVD technique, magneto-sputtering and their analysis.
- Engineering and characterization of materials for photovoltaic applications, e.g. organic and kesterite solar cells.
- Development and characterization of CISS-based materials and devices for spin- and opto-electronic applications.
- Development of thin films of molecular magnets and investigation of their chemical and physical properties for spintronics and quantum computing.
- Synthesis of new materials
- Materials for additive manufacturing technologies
- Materials for the green building sector and waste recycling
- Coatings and surface modification
- Surface engineering
- Chemical, physical, and mechanical surface characterization
- Corrosion and wear resistance characterization

**Healthcare Engineering**

Technologies, methods, and devices for personalized medicine; Wearable/implantable systems; Development of technologies based on Reverse Engineering and A.M. for personalized medicine; Virtual, Augmented and Mixed reality in biomedical field.

Development of a bio-cooperative platform for post-stroke and neurocognitive rehabilitation and assessment

Social robot for physical coaching in pre-habilitation and rehabilitation tasks.

Development of integrated platform as a decision support for diagnosis and treatment of patients with neurocognitive Diseases.

Development of advanced and modular sensors system for the measuring of physiological and movement parameters

Study of bio-markers for assessing and monitoring the progression of neurodegenerative diseases.

Test and validation of integrated solutions for promoting active ageing in private home and residential facilities.

**Turbomachinery**

Methods, numerical tools and experimental investigations to support turbomachinery design and innovation in terms of aerodynamics, aeromechanics, heat transfer and cooling. Applications are gas turbines for power generation, aeroengines, steam turbines, compressors, fans and pumps.

- Compression technologies, including design, optimization and testing of centrifugal compressors and reciprocating compressors for industrial gases and hydrogen
- Numerical and experimental investigation of aerothermal behaviour (heat transfer, cooling, losses) of turbomachinery main flowpath and secondary systems
- Aerodynamics of turbomachinery for industrial and propulsion applications. CFD analysis of turbomachinery (e.g.: gas turbines, steam turbines, centrifugal compressors, pumps, turbo expanders, propellers). Design and optimization of turbomachinery components based on artificial intelligence. Machine-learning techniques applied to turbulence/transition modeling for RANS/URANS methods. High Fidelity CFD simulations.
- Aeromechanics of turbomachinery components, forced response, and flutter.
- Aeroacoustics of turbomachinery components, acoustic liners.

**Innovative combustion technologies and alternative fuels**

Numerical models and experimental methods for the investigation and design support of innovative combustion technologies for propulsion and power generation with particular focus on the use of alternative carbon-neutral fuels such as hydrogen and hydrogen carriers.

- High-fidelity CFD modelling (LES) of turbulent combustion processes in gas turbine and aeroengines to support low-emissions design and fuel flexibility
- High temperature, intermediate pressure testing capability with liquid fuels, natural gas and hydrogen

**Energy systems for a sustainable transition**

Renewable energy: solar, gasification from biomass, geothermal, wind; Technologies for non-programmable renewable sources including collaborative; Smart Grids/Smart Energy systems; Technologies for energy storage and production of green Hydrogen. Innovative cycle configurations with high efficiency gas turbines

- Wind energy, including turbine aero-servo-elastic design, multi-fidelity simulation methods, floating wind, and wind energy power management.
- Modelling of smart energy systems including renewable and storage systems. Development of smart-user, smart-grid control algorithms
- Sustainable HVAC Systems
- Refrigeration with natural fluids

**Sustainable Mobility**

Technologies for mobility with electric and hybrid engines; Energy storage efficiency (batteries/supercapacitors) and charging systems; Development of management strategies, converters and innovative powertrains in electric and hybrid vehicles.

- Innovative propulsion systems for aviation/aerospace (details here) and road vehicles, including hybridization, electrification, innovative combustion technologies and fuels.

**Development of predictive mathematical models and data analysis**

Numerical continuous optimization. Development of prediction models via machine learning and of neural networks, stochastic optimization methods for training the networks, missing data imputation and completion of data in matrices.

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

DIEF is equipped with:

- three HPC scientific computing-oriented data centers with potential for 2500 equivalent cores with the main software for technology and engineering applications;
- Centrifugal compressor test rig, able to test industrial-scale impellers up to a peripheral Mach number of 0.7;
- Reciprocating engine test cells (1 dynamic, 2 eddy-currents), including the possibility of hydrogen feeding and innovative measurement systems;
- Five Axis milling center DMG Mori DMU 75 , five axis milling center Mori Seiki NMV 1500DGC, NC Lathe DMG CTX450;
- Vibration sensors and signal conditioners for modal analysis;

- NI PXI real time control module;
- CMT sources by Fronius (TPS320i and TPS320 robacta)
- Kistler force measurement devices;
- Thermocouples and thermocamera (optris 640i);
- CMM euro APEX from Mitutoyox;
- THT lab (Calenzano site): Air flow delivery systems: Compressed air network 1kg/s @10bar, Large blower 2.5kg/s, 600 kW air preheating up to 450°C;
- Fuel skids: Liquid fuels like JET-A or equivalent stored in 3 x 500 liters tanks and pumped up to 40bar, Natural gas by dedicated compression system, Hydrogen electrolyzer;
- Non reactive warm test cell: 3 different air lines with dedicated valves and orifices;
- Reactive test cell: Maximum exhaust temperature 2000°C, T=450°C, P=10 bara, Exhaust emissions, optical flame detection;
- Rotating rigs - GearBox test section: Experimental measure of losses due by shaft and gear rotation in an air oil mixture environment, high speed up to 18000 rpm multi purpose test section, 4000 rpm 1 stage stator rotor disk cavity rig, Large rotating rig for scaled up internal cooling system 150rpm;
- Measurements techniques: Transient technique with narrow band TLC or Temperature Sensitive Paint, TLC, TSP and InfraRed camera for detailed 2D maps with time resolved resolution, Pressure Sensitive Paint technique (heat and mass transfer analogy), 2D PIV (steady and time resolved), Turbulence with 2 wire probes, High Speed camera 200kHz, DANTEC Phantom, Endoscopic PIV with camera, and laser boroscopes, High temperature water cooled boroscope for reactive test rig, OH* chemiluminescence;

## Advanced materials testing

- Platform for morphological and analytic characterization of surfaces such as scanning probe microscopies (AFM and STM operating in air or UHV down to 30 K), X-ray photoelectron spectroscopy (XPS), Ultraviolet photoelectron spectroscopy (UPS), Low energy ion scattering (LEIS);
- Several instruments for the magnetic characterization of hard and soft magnetic materials (SQUID, VSM, DC susceptometer, magnetometers, AC susceptometers, Cantilever, MOKE, MCD) operating between -12 T and +12 T and between 0,3 – 450 K and different frequencies;
- Electronic Paramagnetic Spectrometers (EPR) operating at X, Q, and W band frequencies, between 2 and 300 K;
- Possibility to use the above-described techniques under irradiation of light of different wavelengths (laser/diodes/lamps);
- Differential scanning calorimeter DSC-1 (Mettler Toledo);
- Single Crystal X-ray diffractometer D8 venture (Bruker), Single Crystal X-ray diffractometer XcaliburPX Ultra (Oxford Diffraction), Single Crystal X-ray diffractometer Xcalibur3 (Oxford Diffraction);
- Powder X-ray diffractometer D8 "Da Vinci" (Bruker), - Powder X-ray diffractometer D8 Advance (Bruker) equipped with a hot chamber (T max = 1600°C), X-ray fluorescence spectrometer X ZSX Primus II (Rigaku), X-ray fluorescence spectrometer EDX 7000 (Shimadzu);
- Hot-stage microscopy LTS420 (Linkam);
- X-ray micro-CT Skyscan 1172 (Skyscan);
- Laboratory-scale plasma treatment equipment;
- RF sputtering and EB-PVD thin film deposition equipment;
- Metallography laboratory, Light and Scanning Electron Microscopy, Electrochemical corrosion evaluation equipment, x Pin on disk and block on disk tribometers;
- Pin on disk and block on disk tribometers.

## Bioengineering

- Custom social robot platforms (ASTRO, CloudIA);
- Humanoid robots (Pepper, Nao);
- Telepresence robot (Ohmni);
- Robot arm (Panda, UR5);
- Wearable sensors for measuring physiological parameters such as ECG, EMG, EEG, and GSR (BioHarness, Shimmer, Mindwave), and motion parameters (XSens, SensHand, SensFoot, Tap), including level of activity and sleep parameters (FitBit, Oura ring);
- Virtual Reality sensors (Oculus);
- 3D Printers for custom prints with plastic and polymeric (including biocompatible) material.

## Moving Lab

- Universal testing machine;
- Test bench for electric motors;
- Non destructive ultrasonic testing equipment;

- Pulsed and continous waveLaser;
- Climate chamber;
- Driving simulator;
- Software and environmental datasets (GaBi, SimaPro);
- Simulation software (Altair Hyperworks, Ls-Dyna, Siemens AMESim, Siemens Prescan, Siemens Madymo, Matlab);

**Infrastructure**
- Test vehicles;
- Data acquisition systems and sensors;
- Drop tower;
- Motorcycle simulator;
- Test rig for battery cells;
- Computing cluster.

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

- **FACTOR** (2010-2017) Full Aero-thermal Combustor-Turbine interactiOn Research, EU FP7;
- **FIRST** (2011-2014) Fuel Injector Research for Sustainable Transport, EU FP7;
- **IMPACT-AE** (2011-2016) Intelligent design Methodologies for low PollutAnt Combustors for Aero-Engine, EU FP7;
- **LEMCOTEC** (2011-2017) Low Emissions Core-Engine Technologies, EU FP7;
- **UNPLUGGED** (2012-2015) Wireless charging for Electric Vehicles, EU FP7;
- **ENLIGHT** (2012-2016) Innovative advanced lightweight materials for the next generation of environmentally-friendly electric vehicles, EU FP7;
- **ROBOBUILD** (2013) Progettazione di un nuovo sistema articolato, Regione Toscana and Romania (Executive Unit for Financing Higher Education R&D and Innovation);
- **RECORD** (2013-2015) Research on Core Noise Reduction, EU FP7;
- **INTEFIX** (2013-2016) INTElligent FIXtures for the manufacturing of low rigidity components, EU FP7;
- **MOREDE** (2013-2016) PhotoVoltaic panels MObile Recycling DEvice, EU CIP-EIP;
- **ENOVAL** (2013-2018) Engine Module Validators, EU FP7;
- **FACTS4WORKERS** (2014-2018) Worker-Centric Workplaces in Smart Factories, EU H2020;
- **RESOLVE** (2015-2018) Range of Electric SOlutions for L-category Vehicles, EU H2020;
- **FLEXTURBINE** (2016-2019) Flexible Fossil Power Plants for the Future Energy Market through new and advanced Turbine Technologies, EU H2020;
- **ALLIANCE** (2016-2019) AffordabLe LIghtweight Automobiles AlliaNCE, EU H2020;
- **SOPRANO** (2016-2020) Investigations on Soot and Radiation in aeroengines, EU H2020;
- **AQUA** (2017) Assemblaggio Quadri Automatizzato, POR FESR 2014 - 2020;
- **TURBO-REFLEX** (2017-2020) TURBOmachinery REtrofits enabling FLEXible back-up capacity for the transition of the European energy system, EU H2020;
- **OBELICS** (2017-2020) Optimization of scalaBle rEaltime modeLs and functIonal testing for e-drive ConceptS; EU H2020;
- **NEOHIRE** (2017-2020) NEOdymium-Iron-Boron base materials, fabrication techniques and recycling solutions to HIghly REduce the consumption of Rare Earths in Permanent Magnets for Wind Energy Application, EU H2020;
- **MeBeSafe** (2017-2020) Measures for Behaving Safely in Traffic, EU H2020;
- **RETROFIX** (2018-2020) Retrofit System for Repairing through Additive Manufacturing, EU MANUNET III;
- **FLOATECH** (2018-2020) Optimization of floating wind turbines using innovative control techniques and fully coupled open source engineering tool EU H2020;
- **START** (2018-2021), Numerical and experimental investigations on an innovative additive manufactured combustor, EU H2020 CleanSky 2;
- **PIONEERS** (2018-2021) Protective Innovations of new Equipment for Enhanced Rider Safety, EUH2020;
- **ARIAS** (2018-2022) Advanced Research Into Aeromechanical Solutions, EU H2020;
- **LEXIS** (2019-2021) Large-scale EXecution for Industry & Society, EU H2020;
- **CHAIRLIFT** (2019-2022), Compact helical arranged combustors with lean lifted flames, EU H2020 CleanSky 2;
- **ACCENTO** (2019-2022), Experimental investigations of Active Clearance Control systems for aeroengines, EU H2020 CleanSky 2
- **METRICS** (2019-2023) Metrological evaluation and testing of robots in international competitions; EU H2020;
- **PHARAON** (2019-2024) Pilots for Healthy and Active Aging, EU H2020;

- **Sviluppo e caratterizzazione di nanocompositi magnetici ibridi per la separazione di miscele gassose** (2020-2022), Ministry of Ecological Transition;
- **FATMOLS** (2020-2023) Fault-tolerant molecular spin quantum processor, EU H2020;
- **SAFE-UP** (2020-2023) proactive SAFEty systems and tools for a constantly UPgrading road environment, EU H2020;
- **INSPIRE** (2021-2024) Inspiring Pressure Gain Combustion Integration, Research and Education, EU H2020 MSCA-ETN;
- **LEONARDO** (2021-2024) MicrovehicLE fOr staNd-Alone and shaReD mObility, EU H2020;
- **MAGNUM** (2022) Macchinario per l'ispezione Automatizzata di assili ferroviari basata sulla Generazione Non Convenzionale di Ultrasuoni tramite Metodologie laser, POR FESR 2014- 2020;
- **ADREANCE** Development of an ADvanced fully REcyclable thermoplastic composite material reinforced by UHMWPE fibers, for the decarbonisation in Automotive, Nautical and construction fields, in the frame of Circular Economy, PRIN PNRR 2022;
- **ECOBAM** Dense Eutectic Ceramic Oxide By Additive Manufacturing: sustainable-by-design materials and technologies, PRIN PNRR 2022;
- **MAVAM** Molecular assisted atom vacancies arrangement to modulate magnetism in 2D transition metal dichalcogenides; PRIN 2022;
- **RISORSA** (2022-2023) RIciclo SOstenibile di magneti di terre rare da Raee per Sistemi elettromagnetici ad Alta efficienza, Ministry of Ecological Transition;
- **Italian Research Center on High Performance Computing, Big Data and Quantum Computing** – Spoke 6 - "Multiscale modeling & Engineering applications", 2022-2025;
- **Italian Sustainable Mobility Center** - Spoke 12 "Innovative Propulsion", 2022-2025;
- **TRANSITION** (2022-2026) Future hydrogen assisted gas turbine for carbon capture process, EU Horizon Europe;
- **HESTIA** (2022-2026) Hydrogen combustion in aeroengines, EU Horizon Europe;
- **NEUMANN** (2022-2026) Innovative aeroengine technologies, EU EDF;
- **TRANS-SAFE** (2022-2026) Transforming Road Safety in Africa, EU HORIZON EUROPE;
- **LIFE2M** (2022-2023) Long LIFE to Micromobility, EU LIFE;
- **IN-MOB** (2023) Innovative Products For Sustainable Micromobility, EU ERDF i3;
- **MOST Centro Nazionale per la Mobilità** - Spoke 5 – Light vehicle and active mobility, MUR PNRR;
- **MOST Centro Nazionale per la Mobilità** - Spoke 9 – Urban mobility, MUR PNRR;
- **DESTINI** (2023-2024) An adapted behavioral robot model with advanced cognitive/physical interaction capabilities for assessment and rehabilitation of neurodegenerative diseases, bando RTD UNIFI;
- **AGE-IT** (2023-2025), MIUR PNRR;
- **THE** Tuscany Health Ecosystem (2022-2025), MIUR PNRR;
- **MICS** Made in Italy Circolare e Sostenibile, MIUR PNRR;
- **Fit4MedRob** (2023-2026) Fit for Medical Robot, MIUR PNRR;
- **ERMES** (2023-2026) Ecosistema uRbano per l'invecchiaMEnto attivo e in Salute, POS Salute traiettoria 1;
- **SMARTCARE** (2023-2026), POS Salute traiettoria 2;
- **XL-Connect** (2023-2026) Large scale system approach for advanced charging solutions, EU HORIZON EUROPE;
- **ACCCELLBAT** (2023-2026) Accelerated cell and battery testing, EU HORIZON EUROPE;
- **HYDEA** (2023-2027) Hydrogen combustion engine demonstrator, EU Horizon Clean Aviation;
- **ROSEMARIE** Recupero e riutilizzO di scarti dell'eStrazione e lavorazione del marmo nell'ottica di una EconoMiA circolare a RIfiuti zEro; Italian Ministry of Economic Development;
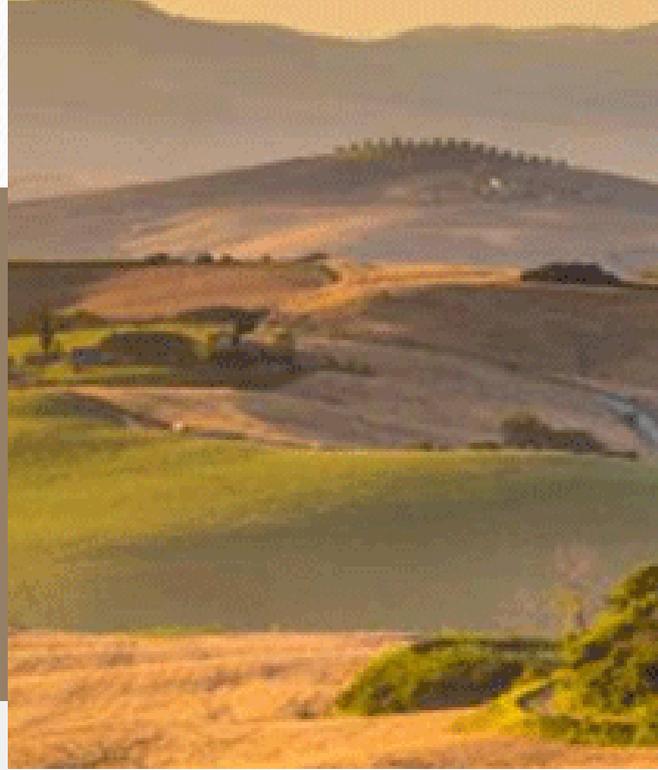
**CONTACTS**

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# DEPARTMENT OF AGRICULTURE, FOOD, ENVIRONMENT AND FORESTRY

www.dagri.unifi.it

The Department of Agriculture, Food, Environment and Forestry (DAGRI) promotes teaching, research and third mission activities in the field of plant and animal production, food quality and technology, environmental protection and recovery, management and enhancement of forest resources. The achievement of these objectives is based on the recognition that the positive relationship and collaboration between the members of the University and the students, companies, national and international territorial bodies and, in general, the Community, constitute the central element of engagement of the Department. The relationship with businesses and local authorities is fundamental, for which the DAGRI represents a point of reference for the transfer of innovations, essential in a context of growing competitiveness in the national and international scenarios. A commitment that takes the form of the study of chemical, physical, biological and genetic processes, the interactions of which characterize agricultural and forestry, natural and semi-natural ecosystems.

The research activities are oriented towards integrated and multidisciplinary studies to determine sustainable management of agricultural, animal and forest resources, maintaining and recovering the environmental quality and the various components of life (soil, microorganisms, climate, plants, animals, biodiversity). DAGRI researchers conduct regional, national and international research projects in the fields of agriculture, forestry, hydrology, environmental engineering, genetic and microbial biotechnology, food science and food production, animal sciences, legislation and agricultural and environmental economics, study, management and monitoring of the landscape.

## ERC MAIN RELEVANT PANELS

- **PE10 Earth System Science**
- **LS2 Integrative Biology: from Genes and Genomes to Systems**
- **LS4 Physiology in Health, Disease and Ageing**
- **LS8 Environmental Biology, Ecology and Evolution**
- **LS9 Biotechnology and Biosystems Engineering**

## KEY RESEARCH ACTIVITIES

The main research lines of the Department are:

- agriculture (agronomy and soil management, arboriculture, crop science, crop production, engineering, precision farming)
- environment and landscape (climate change, relations between urban areas and rural areas, pollution, ecosystem services, land use changes)
- forestry (forest ecology, silviculture, forest management, forest monitoring and inventory, biodiversity, wood science, forest operations, forest engineering)
- animal science and game management
- food science and technology (food quality, food and beverage production processes, food product tracing and certification, sensorial and preference analysis)

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

The Department is organized into 10 sections:
Arboriculture; Economics; Assessment and Legislation; Forests, Environment, Wood and Landscape; Agricultural, Forest and Biosystem Engineering; Agricultural Microbiology; Forest pathology and Entomology; Agronomy, Genetics and Land Management; Animal science; Soil and Plant Science; Food Science and Technology
The Sections have the facilities, infrastructure and equipment to carry out scientific and educational activities.

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

## Clim4Vitis -  Climate change impact mitigation for European Viticulture

Clim4Vitis´ Horizon Europe's project main objective is to strengthen and raise UTAD´s – and more specifically its research group CITAB´s – science and technology (S&T) capacity and performance in two main specific fields of research in viticulture & climate:
- Grapevine modelling;
- Methods and tools for assessing climate change impacts on European viticulture, in general, and on grapevine productivity, quality attributes and risk of diseases and pests in particular
https://clim4vitis.eu/

## EDULIA Bringing down barriers to children's healthy eating

Edulia, part of an H2020ITN-ETN Marie Curie Training Network, responds to the urgent need of the EU society to find new ways to tackle the escalating issue of obesity, through promoting healthier eating from childhood, within the context of choice
https://edulia.eu/

## GERONIMO -  Genome and Epigenome eNabled breedIng in MOnogastrics

GEroNIMO H2020 project will work on chicken and pig, the most used sources of animal protein worldwide, to provide breeders with new knowledge and tools to promote innovative genome- and epigenome enabled selection methods for traits related to production (quantity and quality), efficiency, productive longevity, fertility, resilience and welfare
https://www.geronimo-h2020.eu/

## NOMAD Novel Organic recovery using Mobile ADvanced technology

NOMAD H2020 project aims to develop a mobile solution for production of high-quality organic fertilisers and soil amenders from anaerobically digested organic waste. In line with the EU bio-economic strategy, NOMAD's innovative mobile approach fosters a vibrant organic circular economy model that has the potential to be widely replicated across rural, peri-urban and urban areas
https://www.projectnomad.eu/.

## LIFE SySTEMiC - Close-to-Nature forest sustainable management practices under climate changes

LIFE SySTEMiC's principal aim is to develop a tool to be used for Sustainable Forest Management (SFM) facilitating the choose of the best silviculture practice to preserve forest resilience in relation to climate change
https://www.lifesystemic.eu/it/.

## CONTACTS
### Donatella Paffetti
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# DEPARTMENT OF HUMANITIES

www.letterefilosofia.unifi.it

The Department of Humanities hosts and coordinates a number of disciplines, including philology, philosophy, classical languages and cultures, linguistics, Italian literature, French, Spanish and Portuguese literature. Though they involve distinct research domains and orientations, they are all connected by a common tradition of studies at the University of Florence. This has proven its fecundity for scientific research as well as for cultural transmission more generally and for higher education and teaching. The Department carries out its humanistic research activities on a national and international level, also in relation to the image and centrality, both historical and symbolic, of Florence as the propulsive centre of humanistic culture in its crucial hubs

## ERC MAIN RELEVANT PANELS

- **SH4 The Human Mind and Its Complexity** [SH4_8; SH4_9; SH4_10, SH4_11]
- **SH5 Texts and Concepts** [SH5_1, SH5_2, SH5_4, SH5_6, SH5_7, SH5_8, SH5_9, SH5_10, SH5_11]
- **SH6 The Study of the Human Past** [SH6_8, SH6_13]

## KEY RESEARCH ACTIVITIES

### Research Units

- ABC-Lab (Aesthetics for Biological Conservation)
- BriKnow (Bridges of knowledge)
- EuTradOR (Cultures, Texts and Traditions of the Christian East in dialogue with Europe and Islam)
- FESVEM (Foundations and Ethics of Life Science and Science of Mind)
- FLESC (Comics between philosophy, literature, science and communication)
- GEIST (Genealogy, hermeneutics, historical investigation of the texts)
- LABLITA (building, studying and processing of Italian and multilanguage linguistic resources, with particular regard to spoken corpora and lexical databases)
- Literature, medicine and science
- LOG-LAB (logic and computational thinking, as mainly referred to the structure of language, computation and communication)
- MOODO (Digital Models and Ontologies for Heritage)
- NAF-New Philosophical Anthropology
- OLID (Observatory on Italian and Dialect Lexicon)
- PER DANTE (Dante's oeuvre from a linguistic, philological and interpretative point of view)
- PTS (Aesthetic practices, anthropological transformations, contemporary scenarios: aesthetics, philosophical anthropology, genealogy of concepts)
- Qua-Onto-Tech (Qualitative Ontology and Technology)
- Texts and Forms of Transmission
- UniPare (Research Unit for Paremiology, Geoparemiology and Comparative Paremiology)

### Research fields

- Epigraphy
- Classical, Italian, Romance, Medieval and humanistic philology
- Ancient Christian Literature
- Greek and Latin Languages and Literatures
- Papyrology
- Greek and Roman History
- Historical Geography of the Ancient World
- The general Theory of textual Criticism
- Italian literature (historiography, interpretation and critical theory, archival research)
- Romance languages and literatures
- French, Spanish, Portuguese Literatures from the 16th century to the contemporary
- Italian linguistics
- Glottology
- Glottodidactics
- Aesthetics
- Philosophy of science
- Moral philosophy and bioethics
- Political philosophy, theoretical philosophy and epistemology
- Logic and philosophy of logic
- The history of philosophy
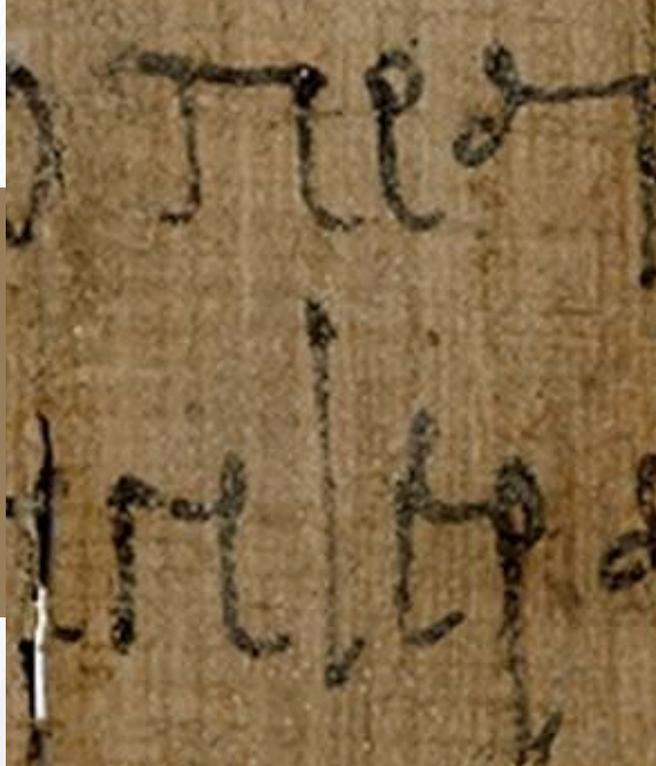
# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

### Papyrological Institute "Girolamo Vitelli"

The Papyrogical Institute draws its origins from the "Italian Society for the Search of Greek and Latin Papyri in Egypt". It organizes excavations on the site of the ancient Antinoopolis and owns one of the biggest collections of papyri, mostly written in Greek, but also in Latin, in the Egyptian language (hieroglyphic, hieratic, demotic, coptic), in Arabic, including also one rare example in Syriac.

### "Aldo Palazzeschi" Study Centre

Created to preserve and enhance the archival materials left by Aldo Palazzeschi to the University of Florence in his will, to promote knowledge of his work in Italy and abroad and encourage research and critical reflection on Italian literature.

### Digital Humanities Laboratory

The DILEF's Digital Humanities Laboratory, namely information technology applied to the study of the humanities, is a center of expertise and services that will enhance research in all the scientific areas of DILEF having common ground in the study and computation/elaboration of texts.
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# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

- ERC Advanced Grant 2017 **ArsNova Multilingual Poetry and Polyphonic Song in the Late Middle Ages**, Principal Investigator Maria Sofia Lannutti, 2019-2024.
- PRIN 2017 **Regenerating the OVI Corpus: Renewal and Optimization of Methods, Contents and Tools**, Principal Investigator Lino Leonardi, Unit Coordinator Maria Sofia Lannutti, 2020-2023.
- PRIN 2017 **Greek and Latin Literary Papyri from Graeco-Roman and Late Antique Fayum (4th BC – 7th AD): Texts, Contexts, Readers**, Principal Investigator: Lucio Del Corso, Unit Coordinator Francesca Maltomini, 2020-2023.
- PRIN 2017 **Languages and Cultures of Ancient Italy. Historical Linguistics and Digital Models**, Principal Investigator Anna Marinetti, Unit Coordinator Francesca Murano, 2020-2023.
- PRIN 2017 **IMPAQTS: Implicit Manipulation in Politics - Quantitatively Assessing the Tendentiousness of Speech**, Principal Investigator Edoardo Lombardi Vallauri, Unit Coordinator Alessandro Panunzi, 2019-2022.
- PRIN 2017 **Models of language variation and change: new evidence from language contact**, Principal Investigator Maria Rita Manzini, 2019-2022.
- PRIN 2017 **The Manifest Image and The Scientific Image**, Principal Investigator: Elena Castellani, 2019-2022.
- PRIN 2022 **Instruments of digital lexicography in support of the OIM (Osservatorio degli Italianismi nel Mondo)**, Principal Investigator: Marco Biffi, 2023-2025.
- PRIN 2022 **ProDEM A Pilot Project in the Digitisation of Epigraphic Manuscripts: Senator Filippo Buonarroti's Papers and Antiquarian Culture under the Last Medicis**, Principal Investigator Giovanni Alberto Cecconi, 2023-2025.
- PRIN 2022 **ALON Archive of the Lexicography of the Nineteenth-Twentieth Century**, Principal Investigator Massimo Fanfani, 2023-2025.
- PRIN 2022 **A Question of Honor: Duels in Italian Culture from the Risorgimento to the Fascist Period, between Imaginary, Representation, and Reality, Principal Investigator**: Irene Gambacorti, 2023-2025.
- PRIN 2022 **Tommaseo Papers Online**, Principal Investigator: Simone Magherini, 2023-2025.
- PRIN 2022 **INTEGRATION INTEllectual miGRATION: circulation of philosophical books and ideas around the ancient Mediterranean through the evidence of Graeco-Roman papyri**, Principal Investigator: Valeria Piano, 2023-2025.
- PRIN 2022 **Petronius and Apuleius: new critical editions and related studies**, Principal Investigator: Giulio Vannini, 2023-2025.
- PRIN 2022 **the ASAP Project Ancient Science, Ancient Philosophy. The Philosophical Foundation of Sciences**, Unit Coordinator Francesco Ademollo, 2023-2025.

- PRIN 2022 **HERB Human Explanation of Robotic Behaviour**, Unit Coordinator Riccardo Bruni, 2023-2025.
- PRIN 2022 **Letters on the net: Eugenio Montale's correspondence (1915-1981). Study and database**, Unit Coordinator Francesca Pia Castellano, 2023-2025.
- PRIN 2022 **Ariosto's library. For a new commentary on 1532 Orlando furioso**, Unit Coordinator Luca Degl'Innocenti, 2023-2025.
- PRIN 2022 **A New Open Access Critical Edition of Dante's "Commedia" Fostering Digital Humanities Projects. Collation of 580 Mss, Provisional Texts and Apparatuses, and Lexical Updatings to the "Vocabolario Dantesco"** (Accademia Della Crusca / Cnr), Unit Coordinator Paola Manni, 2023-2025.
- PRIN 2022 **Corpus SIM (Senectus Ipsa Morbus) Spontaneous speech in healthy ageing**, Unit Coordinator Alessandro Panunzi, 2023-2025.
- PRIN 2022 **Itineraries of Philosophy and Science from Baghdad to Florence: Albert the Great, his Sources and his Legacies**, Unit Coordinator Anna Rodolfi, 2023-2025.
- PRIN 2022 **Early Modern Spanish Theater (1570 - 1700): textual transmission, european circulation, new digital resources,** Unit Coordinator Salomé Vuelta Garcia, 2023-2025.
- FIS3 Starting Grant **Spontaneous Multimodal Communication: Pragmatics and Autism in School-Age**, PI Valentina Saccone
- PRIN 2022 **Lorenzo Mehus and the History of Philology: Archive, Books, Letters (PHILOMEHUS)**, PI Francesco Bausi, 2023-2026.
- PRIN 2022 **Reconstructing Fragmentary Papyri through Human-Machine Interaction: case-studies from two Italian collections**, PI Francesca Maltomini, 2023-2026.
- PRIN 2022 **Science in times of emergency: the role of scientific knowledge in policy-making during crises**, PI Mariano Croce, 2023-2026.
- PRIN 2022 **CHEWIE - Well-Being, Humanism and Civic Economy**, PI Emanuele Pili, 2023-2025.
- PRIN 2022 **Social, Political, and Religious Prognostication and its Roots: Philosophical Strategies for Coping with Uncertainties and Planning the Future**, PI Alessandro Palazzo, 2023-2026.
- PRIN2022 **TheaMed - Theatre and Medecine**, PI Barbara Innocenti, 2025-2027
- PRIN2022 **An integrated approach to negation: core syntactic processes, lexical structure, and linguistic microvariation**, PI Maria Rita Manzini, 2025-2027
- PRIN2022 **Shape of a city. Antinoupolis from the beginning to its end: a topographical, archaeological and papyrological overview**, PI Marcello Spanu, 2025-2027
- Young Researchers, **LANGEST - Estrangement in language: approaching exophonic practices through the lens of philosophy**, Referente Saša Hrnjez, 2022-2025

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# DEPARTMENT OF EDUCATION, LANGUAGES, INTERCULTURE, LITERATURES AND PSYCHOLOGY

www.forlilpsi.unifi.it/

The Department of Education, Languages, Interculture, Literatures and Psychology (identified with the acronym FORLILPSI) was established on 1 January 2019 with the aim of improving the overall efficiency of the departmental organization, resulting from the fusion of two humanistic departments: Education Science and Psychology (SCIFOPSI) and Languages, Literatures and Intercultural Studies (LILSI).

Approved by the respective Department Councils on June 6, 2018, the FORLILPSI cultural project accommodates and merges the scientific and educational experience of the two pre-existing departments. The Department of Education Science and Psychology (SCIFOPSI), established in January 2013 by Law number 240 of December 30, 2010 (with regard to the reorganization of the public university system in Italy), emerged as a new institutional reality, born of the merger between the Department of Education Science and Cultural and Educational Processes, and the Department of Psychology (italian version).

The Department of Languages, Literature and Cross-cultural Studies (LILSI), also established in January 2013, was born as an evolution of the Department of Languages, Literature and Comparative Cultures, in turn a previous unification of the Department of Modern Philology and the Department of Romance Languages and Literature.

Thus, FORLILPSI is an interdisciplinary department that embraces research areas ranging from educational science and psychology to languages, philology and literature. The aim of the department is to conduct research and promote learning in the area of relationships between languages, cultures, minds, behaviors, and education through the investigation of texts and contexts and spatial and temporal dimensions.

Given its composition, as a result of the merger between Italian National University Council (CUN) Areas 10 (LILSI) and 11 (SCIFOPSI), the department also has a strong vocation towards internationalization in terms of research, didactics and the third mission, favoring activation, promotion and acquisition of "cultural agreements", development cooperation, international funding, and support of double degrees for students.

The four pillars of the new department:

Integrated Didactics: Attention to integration between theoretical, empirical and practical perspectives of education, teaching and learning of language and literature also as a research area on the theme of the teacher's role. Specific areas of focus concern profiles of 0-6 teachers and educators, preschool and elementary school teachers, teachers for students with special needs, and of teachers of disciplines with particular attention to didactic, linguistic and psychopedagogical disciplines in secondary schools.

Cross-culturality is intended as: a) A relational, construction dimension regarding the self, others, and gender from a social, historical, theoretical, and literary perspective, an interdisciplinary complex to interpret the phenomena of change that characterize our time;

## ERC MAIN RELEVANT PANELS

- **SH1 Individuals, Markets and Organisations**
- **SH3 The Social World and Its Interactions**
- **SH4 The Human Mind and Its Complexity**
- **SH5 Texts and Concepts**

b) A design dimension for the creation of spaces where comparison and dialogue between different languages, literatures and cultures are possible, within a democratic and inclusive society attentive to giving value to the contributions of minorities.

Interdisciplinarity: Interdisciplinary collaboration among disciplines within the department and those of different scientific areas within the university, to foster in particular research relationships between pedagogical, psychological, linguistic, philological and literary sciences according to different theoretical, historical, methodological and operational approaches in a comparative key.

Promotion of well-being and education: This area of study and research transcends the boundaries of local context and adopts a global perspective to give value to existing differences. This approach enhances the understanding of connections between local and global realities, promotes the understanding of cultural, social-historical, psychological, pedagogical and linguistic factors that influence people's lives, orients professional declination, and develops skills and aptitudes aimed at change and collaboration.
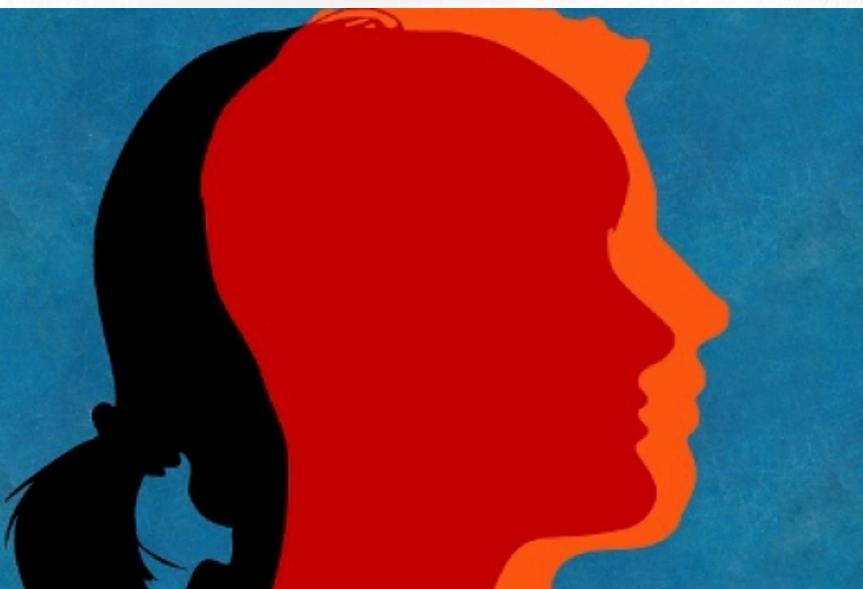


# KEY RESEARCH ACTIVITIES

FORLILPSI research activities focus on the study of the relationships between languages, cultures, behaviours and educational processes, investigated through texts and contexts, as well as spatial and temporal dimensions.

Research is organised around interconnected thematic areas, including:

· cognitive, social and developmental processes across the lifespan;
· language, communication and multilingualism in historical and contemporary contexts;
· educational processes, learning environments and teacher education;
· cultural production, textual transmission and media;
· inclusion, diversity and social cohesion in local and global perspectives.

The Department promotes interdisciplinary research and the integration of theoretical, empirical and methodological approaches, combining qualitative and quantitative methods, comparative perspectives and historical depth.

Within this framework, FORLILPSI provides a favourable research environment for ERC projects in the Social Sciences and Humanities.

# KEY RESEARCH FACILITIES, INFRASTRUCTURE AND EQUIPMENT

**LabOA: Laboratorio Open Access**

LabOA, in collaboration with the editorial coordination of the Department of Education, Languages, Interculture, Literatures and Psychology (FORLILPSI), operates as a lab for academic and digital publishing in open access, promoting the dissemination of scientific literature and supporting research activities in the fields of scholarly communication, open science and digital editorial practices. LabOA plays a central role in the development and management of editorial projects, providing guidance, training and support services primarily within the framework of curricular internships. Particular attention is given to the development of skills in academic writing, editing, text revision, layout design and digital publishing. LabOA fosters experimentation in scientific and cultural communication through the use of digital tools and platforms, and carries out editorial activities including the editing, layout and publication of books, scholarly journals and research outputs. It also supports the design, management and long-term sustainability of digital editorial environments, scientific and scientific-didactic websites, contributing to the dissemination, accessibility and visibility of research results.

The Open Access Project coordinated by LabOA is based on the systematic experimentation with new editorial models, media, tools and environments for humanistic communication in digital formats. Special attention is devoted to the training of students, doctoral candidates, early career researchers and teachers, with the aim of strengthening competences in open access publishing, digital methodologies and responsible research communication. Within this framework, LabOA collaborates closely with the Department's Research Observatory and contributes to the Department's strategies in the areas of open science, academic publishing, research dissemination and public engagement.

LabOA activities include:
· support for open access academic publishing and scholarly communication practices;
· training in academic writing, editing, editorial revision and digital publishing;
· development and management of scholarly journals, book series and digital editorial environments;
· experimentation with digital tools and platforms for the editorial dissemination of humanistic research;
· support for students and early career researchers in publishing and open science practices.

**VIRALab (Valutazione Interventi, Rilevazione e Analisi dati)**

The Intervention Evaluation, Data Collection and Analysis laboratory of the Department of Education, Languages, Intercultures, Literatures and Psychology (FORLILPSI) was created to provide methodological support to teachers and PhD and undergraduate students with regard to research and data analysis. The mission of the laboratory is to provide support to research activities of the department in phases of development and during studies as well as in the analysis and management of data, whether it's qualitative or quantitative.

The objectives of the laboratory are:
· To provide technological support relative to software used to conduct research and analyze data.
· To foster the transfer of skills and knowledge about covered topics by organizing courses and workshops at various levels based on previous experiences in order to make the activities offered by the laboratory accessible to the greatest number of people possible.

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

Over the last decade (2016-2026), FORLILPSI has been awarded 308 funded projects, including 65 European projects (Horizon 2020, Horizon Europe and Marie Skłodowska-Curie Actions), 135 national projects (including 2 FIS and 29 PRIN), as well as international and regional programmes. This funding portfolio reflects the Department's strong positioning in competitive research environments at both national and international levels.

## Funded projects in the last decade (2016-2026)

| Funding Scheme | Number of Projects (2016–2026) | Of which major schemes |
|---|---|---|
| European Projects | 65 | 2 MSCA (HE), 1 H2020 SC |
| National Projects | 135 | 1 FIS2, 29 PRIN |
| International Projects | 20 | |
| Regional Projects | 4 | |
| Programme Agreements | 7 | |
| Other funded projects | 77 | |
| **Total** | **308** | |

## Funded Projects – Detailed Breakdown by Year (2023-2025)

| Year | Total | European | National | International | Regional | Programme Agreements | Other funded projects |
|---|---|---|---|---|---|---|---|
| **2025** | 25 | 2 | 5 | 6 | 1 | 1 | 10 |
| **2024** | 28 | 7 | 4 | 4 | 0 | 1 | 12 |
| **2023** | 37 | 8 | 15 | 3 | 0 | 3 | 8 |

## CONTACTS

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# DEPARTMENT OF HISTORY, ARCHAEOLOGY, GEOGRAPHY, FINE AND PERFORMING ARTS

www.sagas.unifi.it/

The SAGAS Department was established in 2013 by uniting most of the disciplines in the fields of history, geography, archaeology, history of fine and performing arts, previously active in various departments, and currently consists of 79 professors and researchers. The department's research and teaching interests extend from prehistory, classical and Near Eastern archaeology, physical and social geography, medieval, modern, and contemporary history, and the history of fine and performing arts from the medieval age to the contemporary world. The disciplines cultivated in the department are linked to the tradition of humanistic studies of the University of Florence and the former Institute of Advanced Studies, seeking an extension that corresponds to the new directions of research, with particular reference to the field of digital humanities, global history studies, environmental history, and public history. In the Department, various research units have been set up, which coordinate the activities of scholars in specific fields. In recent years, particular attention has been paid to public engagement activities. There are numerous research activities in collaboration with public and private institutions, in Italy and abroad. The Department has been qualified as a Department of Excellence for 2018-2022 and 2023-2027.

## ERC MAIN RELEVANT PANELS

- **SH5 Texts and Concepts** [SH5_2, SH5_5]
- **SH6 The Study of the Human Past**
- **SH7 Human Mobility, Environment, and Space** [SH7_1, SH7_7, SH7_10]
- **SH8 Studies of Cultures and Arts** [SH8_3, SH8_4, SH8_5, SH8_6, SH8_7, SH8_8]

## KEY RESEARCH ACTIVITIES

- Archaeological investigation from prehistory to the classical world, the Near East, and the Middle Ages;
- Political, economic, social, religious, cultural history from ancient times to the contemporary world;
- Physical and social geography.
- History of fine and performing arts;
- Library science, archiving and palaeography;
- Cultural anthropology.

# KEY RESEARCH FACILITIES, INFRASTRUCTURES AND EQUIPMENT

In 2018 the Interdisciplinary Laboratory on Cultural Heritage (LiEC) was established (with its own regulations and a steering committee); a unit staff recruited in 2019 on the Excellence Plan was destined to its technical coordination. The LiEC has well-equipped spaces for research activities and doctoral studies including photo laboratory, photo archive, media library, computer equipment, 3D laser scanner, three total stations, planetary scanner, drone for low-altitude filming. The Project of Excellence 2023-2027 will reinforce already established lines of development of the Laboratory.

# INVOLVEMENT IN NATIONAL AND EUROPEAN RESEARCH FUNDING PROGRAMMES

- **Horizon 2020** programme: 2 **ERC**s (2019: as partner; 2020: as PI); **COST Action** (2018); 4 Individual Fellowships **Marie Skłodowska-Curie Actions** (2019, 2021, 2024, 2026), **JPICH Conservation and Protection Call** (2020), participation in the Horizon 2020 Strengthening links Project (2020-2023);
- 1 **FARE** project;
- **Unesco** programme: Partnership on training activities - Afghanistan (2019);
- programmes of the **Italian Development Cooperation Agency** (**AICS**): 4 projects (2019, 2020, 2021, 2024);
- international cooperation projects financed by **MAECI** for the cataloguing (through georeferenced databases), management and valorisation of tangible and intangible cultural heritage functional design and spatial planning in the contexts of Mandalay (Myanmar), Herat and Bamiyan (Afghanistan);
- **MUR** programs: 7 **PRIN** 2017; 5 **PRIN** 2020 (the largest number of PRINs funded in the Florentine University); 22 **PRIN** 2022; 6 **PRIN PNRR** 2022; **FISR** (2020); **FIRE** (2022);
- **Tuscany Region** programs: 3 Regional Operational Programmes co-financed by the **European Social Fund** (2020); Regional Strategic Plan (2020); 2 projects on the "Bando Memoria" (2018, 2019) and 9 others on other regional funds (2020-2024);
- memorandums of understanding with 111 private and public bodies, research centers and institutions, universities, and private companies and financed by the **Ministry of Foreign Affairs**; 24 archaeological missions (2022-2026).
- The Department acquired resources amounting to 7.5 million in the four-year period 2023-2026.
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