Fondazione Ri.MED

ANNUAL REPORT 2025

Fondazione Ri.MED

FOUNDING PARTNERS

Presidenza del Consiglio dei Ministri

Regione Siciliana

Consiglio Nazionale delle Ricerche

University of Pittsburgh

UPMC LIFE CHANGING MEDICINE

PARTNER

UPMC IRCCS ISMETT Palermo

Paolo Aquilanti
PRESIDENT AND CEO

I am pleased to present the progress achieved by the Ri.MED Foundation in 2025, reflecting our commitment to research, advanced training, and scientific outreach, alongside the steady advancement of the new Research Center.

New **professional profiles** were integrated to strengthen research teams, technological platforms, and projects. Over the year, the Foundation hosted 39 PhD students and 30 trainees, confirming its focus on developing highly qualified human capital.

Within the **Gender Equality Plan** (GEP), Ri.MED launched #Fe.Male in Research, a newsletter presenting selected articles on sex- and gender-related differences in biomedical research, supporting more effective scientific and medical practices.

The **Ri.MED Scientific Symposium**, "Engineering Biology for Next-Generation Medicine", reinforced its international standing, welcoming participants from 14 countries and distinguished speakers. In addition, two international workshops - the COST Action and EMBO Workshops - were held in Palermo, the cycle of monthly seminars with our clinical partner IRCCS ISMETT.

Public engagement initiatives, including the round-table "Tailor-Made Biology" and the increasing of the school outreach activities, fostering scientific culture with a broad audience and reinforcing the territory's emerging role as a Life Sciences hub.

Regarding the **Ri.MED Research Center in Carini**, the Foundation managed a complex phase linked to contractor difficulties. Careful oversight preserved project continuity: edil works are over 70% complete, with installations and equipment well underway.

Finally, the **Ri.MED network** expanded: we were invited to participate in the Qatar mission promoted by the Ministry of Foreign Affairs and ICE Agency, with the Italian Embassy, Assobiotec, and Farmindustria. In 2025, 7 new agreements were signed, bringing active collaborations to 55 with leading institutions in Europe and the United States.

These results were made possible thanks to the continued support of our founding partners—the Presidency of the Council of Ministers, the Region of Sicily, CNR, the University of Pittsburgh, and UPMC—as well as all Ri.MED staff, whose dedication and expertise drive the development of our vision.

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Ri.MED OVERVIEW 2025

Networking

7 active agreements for labs management

55 active scientific collaborations and Technology Transfer agreements

7 new agreements signed in 2025

Training & employment

HUMAN RESOURCE in 2025

81 employees

60% 40%

33 fellows

39 PhD students

30 trainees

Scientific knowledge dissemination

205 hours of training in schools

8 Ri.MED events

76 scientific publications

Fundings for Research

716,883 € awarded in 2025 through competitive calls

28,016,692 € awarded IN TOTAL through competitive calls

Intellectual property

33 patents portfolio up to 31.12.2025

Building the Research Center

600 planned occupancy opportunities

17,070 sq m of buildings

232,000,000€ value of the investment

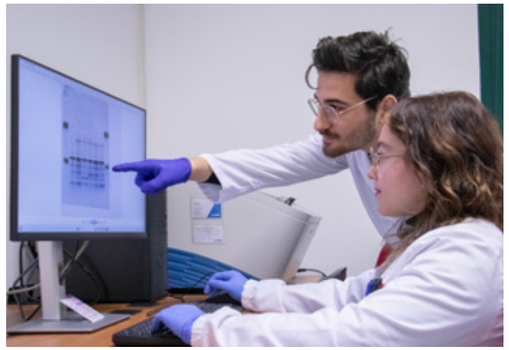
HUMAN RESOURCES

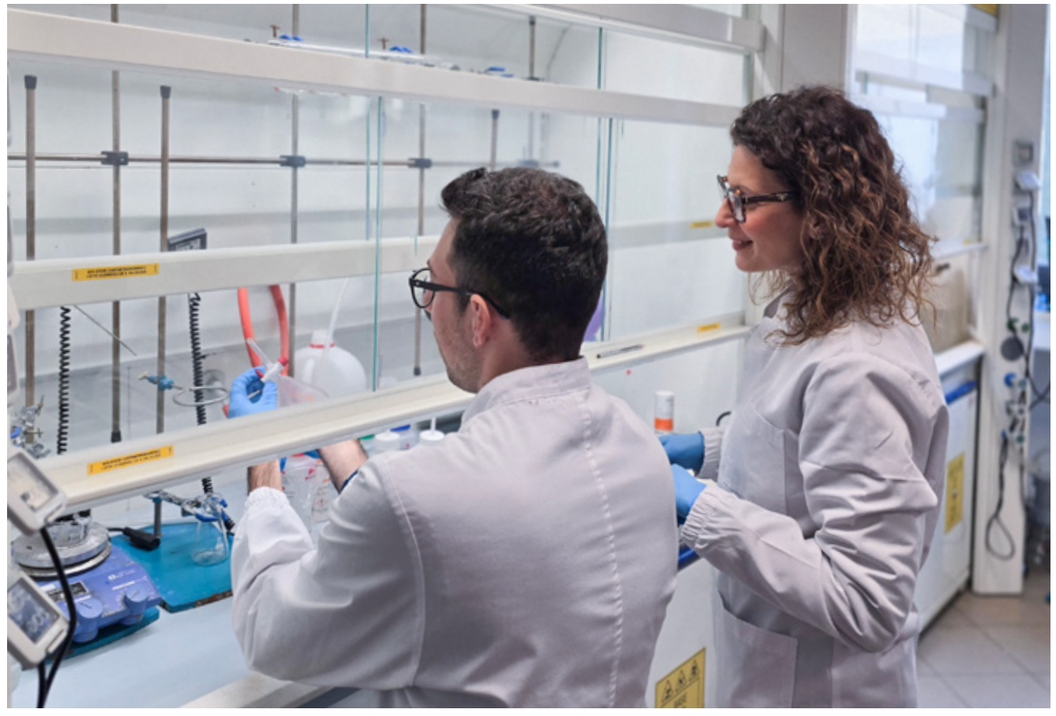
NURTURING NEW TALENTS

Investing in human capital is one of Ri.MED's foundational commitments. The Foundation continues to invest in the recruitment, training, and professional growth of highly qualified individuals, recognizing that **scientific excellence and organizational strength are built on people, skills, and a shared vision**.

In 2025, Ri.MED further advanced its organizational growth, reaching a total of 81 employees and continuing to expand its research and training community. Alongside its permanent staff, the Foundation hosted **39 PhD students** and welcomed **30 interns**, reaffirming its role as a dynamic environment where education, research, and innovation converge. The continuous integration of early-career researchers into multidisciplinary teams fosters knowledge exchange, strengthens institutional capacity, and enhances the Foundation's long-term impact.

By aligning organizational expansion with structured training pathways, Ri.MED continues to cultivate a **forward-looking scientific community**, nurturing talent while reinforcing its position as a growing and competitive biomedical research institution.





HUMAN RESOURCES

GROWING TOGETHER

In 2025, the Ri.MED Foundation's team consisted of **150 members**, including employees and fellows, with researchers forming the core of its activities. Over the year, the Foundation successfully carried out **29 recruitment procedures**, 27 of which were dedicated to research roles, reflecting its ongoing commitment to maintain and strengthen scientific capacity.

Ri.MED continues to nurture local talent while attracting expertise from around the world. Approximately **20% of its researchers are Sicilians who have returned home** to take advantage of the professional opportunities offered by the Foundation, and **15% come from other countries**, further enhancing Ri.MED's international profile.

For years, Ri.MED has been recognized by the Italian Ministry of University and Research (MUR) as **an authorized institution to host researchers from non-EU countries**. This international vision is also supported through partnerships with the University of Pittsburgh and UPMC, enabling researchers to participate in rotations at top scientific institutions, in line with EU recommendations on mobility as a driver of research networks and European leadership in science.

With the upcoming opening of Ri.MED's new research center in Carini, near Palermo, and the backing of new research funds, the Foundation is poised for continued development. In the coming years, Ri.MED will further strengthen its research teams and consolidate its position as a leading international host institution for biomedical research.

HUMAN RESOURCES

GENDER EQUALITY PLAN

Different perspectives, more inclusive innovations

The year 2025 marked the conclusion of the first three-year Gender Equality Plan (GEP) cycle. Several new initiatives were launched, while ongoing activities were further strengthened. Among them, particular attention was given to the Fe.Male in Research campaign, an alternative training initiative developed through a bottom-up approach, allowing researchers to freely select topics highlighting sex and gender differences in scientific outcomes. The six issues, shared with all Ri.MED staff via email, aimed to raise awareness of the limitations of scientific research when sex and gender are not adequately considered. Inspired by the slogan of the year **"Different perspectives, more inclusive innovations"** the initiative emphasized that diversity in perspectives is not only an ethical value but also a key driver for more comprehensive and impactful scientific innovation.

Several other initiatives were implemented throughout the year. Ri.MED carried out its annual data collection and monitoring addressed to internal staff, while also promoting gender equality within school-based training programs (former PCTO) by integrating practical recommendations into dedicated guidelines shared with personnel involved in educational activities. The GEP webpage was constantly updated to ensure up-to-date information always available to staff and stakeholders.

A new campaign, **Fe.Male in Society**, was conceived and will be launched in early 2026, focusing on how sex and gender differences influence everyday life and society; similarly to the previous initiative, it will adopt a bottom-up approach, actively engaging Ri.MED staff in content development. Furthermore, a first storytelling draft was designed in connection with the GEP training on unconscious bias addressed to selection committee members. Following approval, an external provider will be appointed to produce a video that will be shared with committee members prior to each evaluation session. Finally, an in-person training event entitled "Gender Equality Plan: Results, Impact and Future Perspectives" has been scheduled for 4 February 2026 and will be addressed to all Ri.MED staff.

At the end of the year, the revision of the Gender Equality Plan was initiated in preparation for the new 2026–2028 cycle. The update aims to align Ri.MED's initiatives with broader European strategies on gender equality and social inclusion, including policies addressing all forms of discrimination, according to the EU strategies (2026/2030) currently under publication. The revised plan will not only address sex and gender equity within the workplace and research environment, but also include targeted training on unconscious bias, mentorship programs for underrepresented groups, and initiatives fostering inclusive communication, accessibility, and cultural awareness across all Ri.MED activities through co-creation framework.

The 2025 snapshot of Ri.MED shows a balanced workforce, with women representing 54% and men 46%, reflecting no significant gender overrepresentation and a continued reduction of the gap compared to 2023. Work–family reconciliation policies remain a priority, as seen in the renewal of smart working contracts and the continuation of flexible work arrangements, supporting staff in balancing professional and personal responsibilities. These achievements demonstrate the Foundation growing awareness and determination towards equality and inclusion, in line with European Union Strategy, positioning Ri.MED for a more equitable and inclusive 2026–2028 cycle.

DISSEMINATION OF SCIENTIFIC KNOWLEDGE

SCIENTIFIC EVENTS

In line with its institutional mission, the Ri.MED Foundation places strong emphasis on the dissemination of scientific knowledge and on promoting dialogue around research advances and across fields.

The **2025 edition of the Ri.MED Scientific Symposium**, **titled "Engineering Biology for Next-Generation Medicine,"** took place on October 16–17, 2025 at Palazzo dei Normanni, an historical and artistic landmark in the city of Palermo. The event convened leading international scientists for two days of discussion focused on how emerging approaches in biological engineering are reshaping the future of medicine.

The symposium was chaired by Giulio Superti-Furga, Scientific Director of the Ri.MED Foundation and of CeMM, Tanja Kortemme, Vice Dean of Research and Professor at UCSF; Ben Lehner, Head of Generative and Synthetic Genomics at the Wellcome Sanger Institute; Lucia Altucci, Member of the Ri.MED Scientific Committee and Professor at the University of Campania "Luigi Vanvitelli"; Massimo Pinzani, Scientific Director of IRCCS ISMETT and Professor and Chair of Hepatology at University College London; and Antonio Cattaneo, Member of the Ri.MED Scientific Committee and Director of the Bio@SNS Laboratory at the Scuola Normale Superiore.

A distinctive feature of the 2025 edition was the invitation extended to all speakers to devote one-third of their presentation to an open and forward-looking reflection. In addition to sharing their latest scientific advances, they were encouraged to explore—freely and speculatively—what the next decade may bring to their field, particularly in terms of medical and practical applications. This format fostered bold thinking and candid discussion, giving rise to a truly innovative and intellectually stimulating exchange of ideas that resonated strongly with the audience.

Building on previous editions, the 2025 Symposium further strengthened opportunities for interaction. Digital audience engagement tools were introduced to encourage real-time participation, while a dedicated poster session provided early-career and established researchers alike with the opportunity to present their work and foster scientific dialogue. The session was hosted in the historic setting of Palazzo Fatta.

The Symposium welcomed participants from 14 countries and was met with highly positive feedback, confirming its role as a growing international platform for scientific exchange. Through the coordinated efforts of its press office, the Foundation ensured broad dissemination of key research insights, extending the reach of the event beyond the scientific community to the wider public.

These initiatives reflect Ri.MED's ongoing commitment to advancing knowledge sharing, nurturing international partnerships, and increasing awareness of cutting-edge biomedical research.

In addition to the annual Scientific Symposium, 2025 saw Ri.MED Foundation host two major international meetings, and a series of internal scientific seminars for the sharing of research advances among scientists working in various areas of research at the Foundation.

From 9–12 September 2025, Ri.MED organized the **EMBO Workshop "When Predictions Meet Experiments: The Next Challenges in Structural Biology"** at Palazzo Branciforte in Palermo. The event brought together scientists from 20 countries to explore the integration of experimental structural biology with emerging AI-driven predictive approaches.

Key lectures addressed the growing synergy between computational models and laboratory validation.

A highlight was the talk by David Baker, Nobel Laureate in Chemistry 2024, who illustrated how deep learning is enabling the design of entirely new proteins with potential applications in therapeutics, vaccines, sustainable enzymes and diagnostics. Through interdisciplinary discussion and poster sessions, the workshop fostered collaboration between experimentalists and computational scientists, reinforcing Sicily's visibility in the life sciences landscape.

We thank Caterina Alfano at Ri.MED Foundation for serving as the on site co-organizer of the workshop, in collaboration with colleagues from international Institutions.

Earlier in the year, Palermo hosted the **final meeting of COST Action CA20117 Mye-InfoBank, dedicated to transforming molecular profiles of myeloid cells into biomarkers for inflammation and cancer**. The meeting gathered researchers, bioinformaticians and clinicians to advance the reuse and integration of large-scale molecular datasets, aiming to develop standardized and clinically relevant biomarkers.

We thank Chiara Cipollina, Nicolina Sciaraffa and Claudia Coronnello at Ri.MED Foundation for serving as the local hosts of the Mye-InfoBank COST Action network during the meeting in Palermo.

During 2025, a series of internal scientific seminars was held in person or online, where researchers working in different areas and at different sites of the Ri.MED Foundation connected to share their research updates through live talks and presentations. This was a great place for scientific exchange and stimulating discussions across all areas of research, from Drug Discovery through Regenerative Medicine and Immunotherapy, to Bioengineering and Tissue engineering.

By promoting international networking and cross-disciplinary dialogue, all these events offered everyone the occasion to strengthen scientific collaboration in an international landscape, and reaffirmed the Foundation commitment to open exchange and research excellence.

DISSEMINATION OF SCIENTIFIC KNOWLEDGE

PUBLIC ENGAGEMENT

Promoting scientific culture and engaging a broad and diverse audience remains central to Ri.MED's mission. In 2025, the Foundation strengthened its dialogue with citizens, institutions and schools through initiatives designed to make science accessible, participatory and socially relevant.

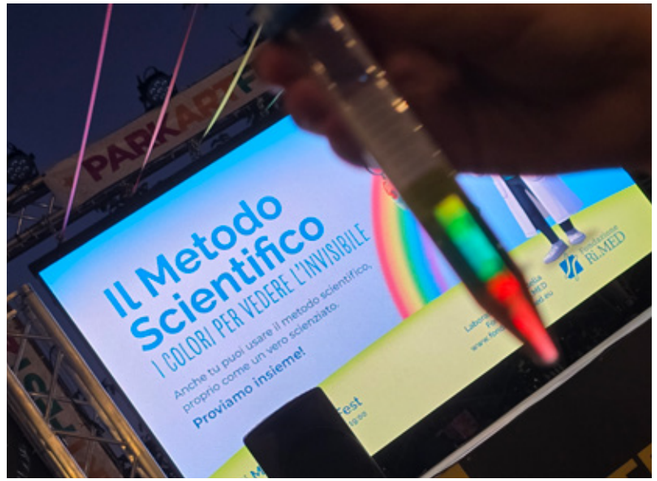
On October 15, 2025, Ri.MED organized the institutional panel discussion **"Biologia su misura – quando la scienza progetta la salute"** at Palazzo dei Normanni. Conceived as a prelude to the 2025 Scientific Symposium, the event explored the frontiers of engineered biology and highlighted Sicily's growing role as a hub for innovation.

Moderated by Antonio Giordano (Innovation Island), the round table created an open dialogue between researchers, policymakers and citizens, addressing topics such as bio-mimicry, cell engineering, computational models and artificial intelligence applied to biomedical research.

Public engagement in 2025 also extended to the international dimension of science diplomacy.
On September 12, during the Conference of Science Attachés in Naples, the Italian Ministry of Foreign Affairs and International Cooperation conferred the "**Italian Bilateral Scientific Cooperation Award"** to Giulio Superti-Furga, Scientific Director of Fondazione Ri.MED, in the presence of Antonio Tajani and Anna Maria Bernini. The recognition highlighted the value of international scientific collaboration as a bridge between research, institutions and society.

Ri.MED also participated for the eighth consecutive year in **SHARPER – European Researchers' Night** in Palermo, welcoming nearly 3,000 visitors despite severe weather conditions.

The 2025 edition, titled "Multicolour Science," featured interactive laboratories engaging children and families through hands-on experiments, from simple chemical reactions to creative demonstrations inspired by tissue engineering. Visitors also explored Ri.MED's research in medicinal chemistry and regenerative medicine, highlighting its patient-oriented approach.



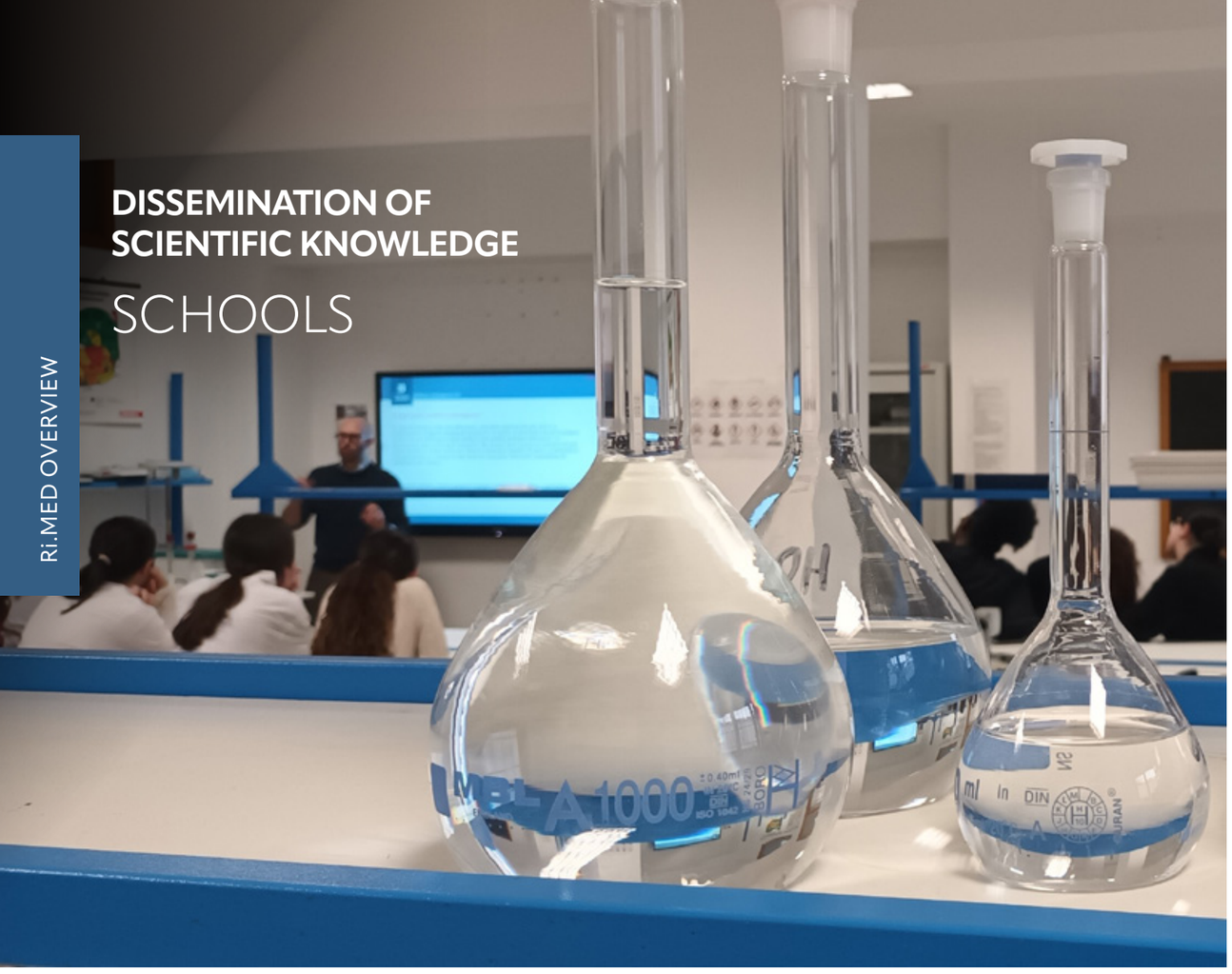
Community engagement continued in Carini during the fourth edition of **Park Art Fest**, where Ri.MED organized the workshop "The scientific method: the colors to see the invisible." Fifty young participants explored the five steps of the scientific method through interactive activities combining curiosity and experimentation.

Science outreach also extended to upper secondary students through participation in **"BOARDING@ SCIENCE"** organized by Consiglio Nazionale delle Ricerche in Palermo. On October 21–22, Ri.MED researchers met participating classes with the seminar "Meet Ri.MED: discover what a researcher does and the opportunities offered by the Foundation" and the hands-on activity "Cell therapies: from the laboratory to the patient." The initiative fostered direct dialogue between scientists and students, reinforcing the idea that research is not only knowledge, but also inspiration and future.

Through these initiatives, Ri.MED reaffirms its commitment to fostering scientific literacy, strengthening its bond with the local community—particularly in Carini, future home of the Research Center—and promoting an inclusive culture of innovation.

DISSEMINATION OF SCIENTIFIC KNOWLEDGE

SCHOOLS



The 2025 activities dedicated to secondary schools successfully concluded with the participation of 15 school institutes and **more than 450 students**, who enthusiastically took part in the Ministerial Programme - "Formazione Scuola-Lavoro" (School-to-Work Training Programme) offered by Fondazione Ri.MED. The programme combined lectures, hands-on laboratory activities and interactive discussions, made possible by the dedication of Ri.MED researchers and the active engagement of students.

Educational modules addressed a broad range of topics related to biomedical research and innovation, providing students with direct exposure to real laboratory environments and practical applications of scientific knowledge.

Ri.MED also organized thematic seminar sessions at the request of School Principals or directly initiated by students, with the guidance of their teachers. Some of these activities took place during "Student Week," a program adopted by numerous high schools to offer experiential learning opportunities, skill development, and active engagement in school life, providing constructive alternatives to the traditional classroom setting. This integrated approach—linking theory, experimentation and dialogue—aims to strengthen students' awareness of Science, Technology, Engineering and Mathematics (STEM) career paths while fostering critical thinking, curiosity and self-confidence.

A significant milestone in 2025 was the signing of a five-year agreement (2025–2030) with the Liceo Classico Garibaldi in Palermo, established to promote interest in scientific disciplines among high school students. Rooted in Curiosity —driving force of both research and youth—the partnership provides for the active involvement of Ri.MED researchers in curricular and extracurricular activities, including seminars, training sessions and guided visits to the Foundation's laboratories.

Through these initiatives, Ri.MED continues to invest in the personal and professional growth of younger generations, promoting equal opportunities, countering stereotypes in STEM fields and contributing to the development of a scientifically aware and motivated community.

DISSEMINATION OF SCIENTIFIC KNOWLEDGE

PRESS


ricerca& innovazione

Biomedicina e biotecnologia per la salute di uomo e ambiente

La Fondazione Ri.MED in Sicilia crea soluzioni inedite secondo l'approccio One Health

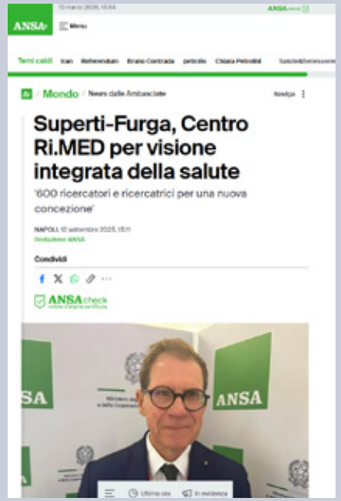

PALERMOTODAY

Embo Workshop, Rimed porta a Palermo l'eccellenza mondiale della biologia strutturale

David Baker, premio Nobel per la chimica 2024, tra i protagonisti dell'evento organizzato dalla Fondazione


ABOUTPHARMA

Sviluppata un'interfaccia "intelligente" per migliorare la biocompatibilità dei dispositivi vascolari, rendendoli più sicuri


ANSA

Superi-Furga, Centro Ri.MED per visione integrata della salute

'600 ricercatori e ricercatrici per una nuova concezione'


CONTENUTO PER GLI ABBONATI PREMIUM

Il RiMed apre e cerca giovani ricercatori

Corsa per ultimare i lavori entro 12 mesi. Il centro d'eccellenza di Carini aprirà le porte a oltre 600 studiosi


>> Italpress

Fondazione Ri.MED in missione a Doha con la delegazione italiana


PALERMOTODAY

In arrivo 3 milioni per un polo di ricerca biomedico e veterinario all'Istituto zootecnico

La Regione Siciliana punta su ricerca e innovazione. L'assessorato regionale alle Attività produttive, guidato da Edy Tamajo, stanzierà circa un milione di euro, a valere sui fondi Poc, per il progetto Ispemi, promosso da Rimed e Izsmett presso l'Istituto zootecnico di Palermo. Si tratta di risorse


GIORNALE DI SICILIA

Rimed, svolta hi-tech nei dispositivi medici


NOVA.news

Accordo tra la Fondazione Enea Tech e Biomedical e Fondazione Ri.Med per lo sviluppo della ricerca biomedica in Italia


in salute

Materiali che si 'nutrono' come cellule viventi: la rivoluzione della biologia sintetica made in Italy


GIORNALE DI SICILIA

Il grande patto per la ricerca biomedica


GIORNALE DI SICILIA

CARINI

Fondazioni Rimed e Cutino insieme per la ricerca


PALERMOTODAY

CRONACA

TRIBUNALI-CASTELLAMMARE

Fondi pubblici per la ricerca scientifica: Ri.Med tra i beneficiari dei finanziamenti della dismessa Fondazione Ime


la Repubblica 50 Palermo

Al liceo Garibaldi di Palermo la prima scuola con indirizzo biomedico in collaborazione con Ri.Med

L'accordo è stato firmato ieri a scuola. Previste ore curriculari ed extracurriculari con la partecipazione dei ricercatori della Fondazione. La preside Marcellino: "Il dialogo tra scienza e sapere umanistico è fondamentale"


MEDICINA INTEGRATA

La relazione benefica fra caffè e microbiota intestinale


PALERMOTODAY

CRONACA

Palermo capitale della biologia su misura: al via il simposio internazionale di Rimed

Una tavola rotonda ha anticipato l'evento dedicato all'ingegneria biologica applicata alla medicina. Esperti e istituzioni insieme per discutere delle nuove frontiere tra biotecnologie, intelligenza artificiale e salute personalizzata

insanitas

MILLE STORIE

Dispositivi cardiovascolari, progetto innovativo di uno scienziato palermitano della Ri.MED

GIORNALE DI SICILIA

Rimed, al direttore un premio per l'innovazione scientifica

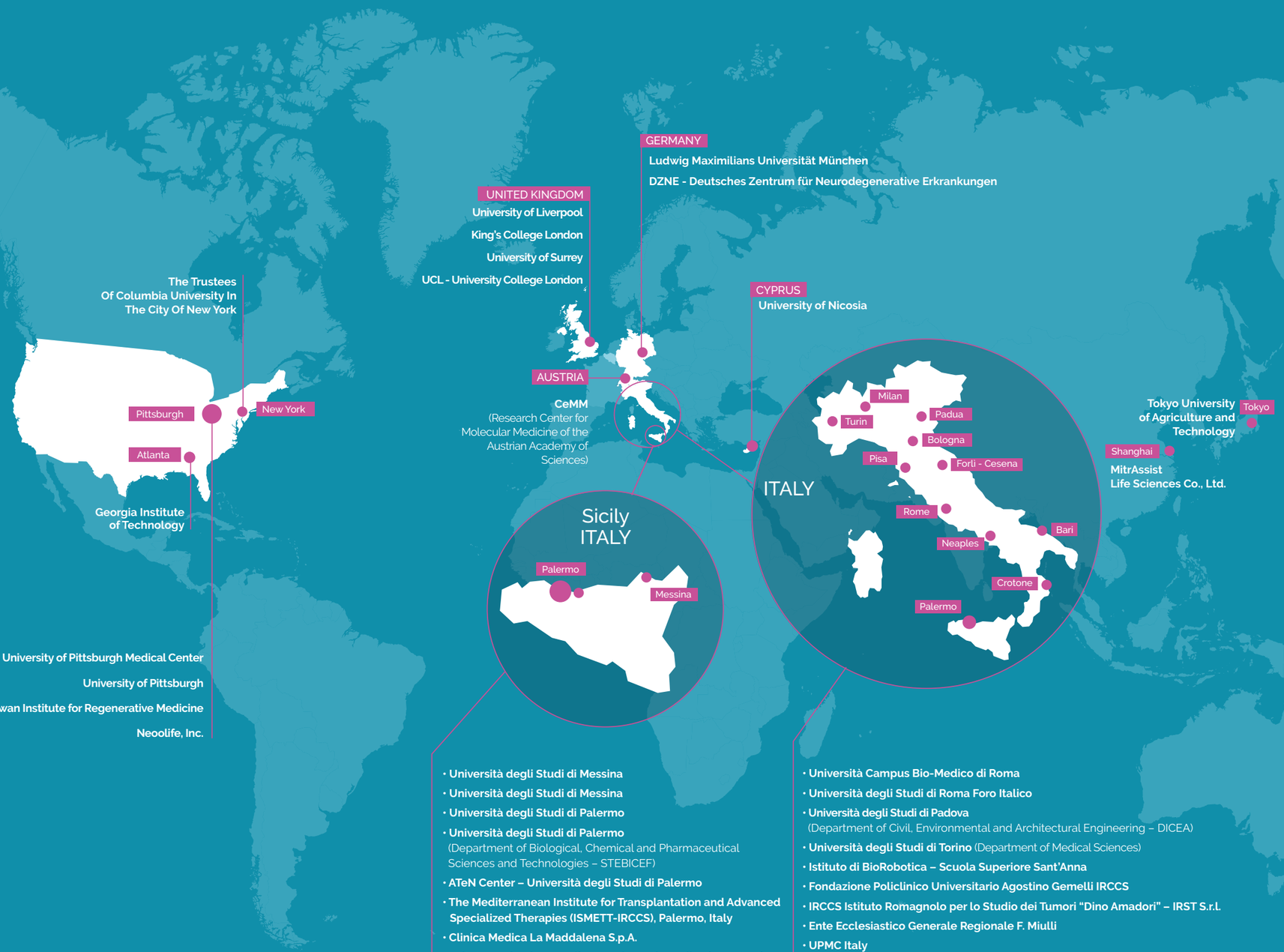
NETWORKING

PARTNERSHIPS & COLLABORATIONS

Collaborations aim to integrate complementary skills with joint translational research projects, maximizing critical mass and enhancing the prospects for success.
Ri.MED prioritizes the continuous development of its network of scientific collaborations and scientific agreements with centers and institutions operating in its areas of interest: there are currently 55 agreements in place for the development of technological innovation, promotion of research activities, and sharing laboratories and resources with national and international institutions. A total of 7 agreements were signed in 2025.

Ri.MED has 7 ongoing agreements for lab hosting, such as the management of the Regenerative Medicine and Immunology laboratories at ISMETT, which are of strategic importance for integrating basic and clinical research; the Experimental Lung Research lab at CNR; and the Preclinical *In Vivo* Research Group at the Experimental Zooprophylactic and Zootechnical Institutes of Sicily. Ri.MED also manages the Structural Biology and Biophysics labs, the Tissue Engineering Lab, the Bioengineering and Medical Devices Lab, the Medicinal Chemistry Lab and the Imaging and Radiomics Lab at various sites of the University of Palermo. Additionally, Ri.MED has leased suitable spaces to establish the Advanced Data Analysis and Molecular Informatics laboratories.

A key strategic milestone in 2025 was Ri.MED's admission to APRE (Agenzia per la Promozione della Ricerca Europea). This membership consolidates Ri.MED's standing within the national and international scientific ecosystems, serving as a catalyst for institutional synergies and cross-border collaboration.
In 2025 Ri.MED attended the BIO International Convention in Boston with the support of the Italian Trade & Investment Agency, the governmental agency fostering business development of Italian companies abroad and promoting the attraction of foreign investments in Italy.



- **Università degli Studi di Messina**
- **Università degli Studi di Messina**
- **Università degli Studi di Palermo**
- **Università degli Studi di Palermo**
  (Department of Biological, Chemical and Pharmaceutical Sciences and Technologies – STEBICEF)
- **ATeN Center – Università degli Studi di Palermo**
- **The Mediterranean Institute for Transplantation and Advanced Specialized Therapies (ISMETT-IRCCS), Palermo, Italy**
- **Clinica Medica La Maddalena S.p.A.**
- **Istituto per la Ricerca e l'Innovazione Biomedica (IRIB-CNR)**
- **Istituto Zooprofilattico Sperimentale della Sicilia (IZS)**
- **Istituto Sperimentale Zootecnico per la Sicilia (ISZS)**
- **Agenzia Regionale per la Protezione dell'Ambiente Sicilia**

- **Università Campus Bio-Medico di Roma**
- **Università degli Studi di Roma Foro Italico**
- **Università degli Studi di Padova**
  (Department of Civil, Environmental and Architectural Engineering – DICEA)
- **Università degli Studi di Torino** (Department of Medical Sciences)
- **Istituto di BioRobotica – Scuola Superiore Sant'Anna**
- **Fondazione Policlinico Universitario Agostino Gemelli IRCCS**
- **IRCCS Istituto Romagnolo per lo Studio dei Tumori "Dino Amadori" – IRST S.r.l.**
- **Ente Ecclesiastico Generale Regionale F. Miulli**
- **UPMC Italy**
- **Marrelli Health S.r.l.**
- **Consiglio Nazionale delle Ricerche (CNR)**
- **Istituto Na zionale di Fisica Nucleare (INFN)**
- **Istituto di Farmacologia Traslazionale (IFT-CNR)**
- **Istituto di Bioimmagini e Fisiologia Molecolare (IBFM-CNR)**
- **European Brain Research Institute "Rita Levi-Montalcini"**
- **Fondazione ENEA Tech e Biomedical**
- **Fondazione IRET ETS**
- **ARTES 4.0 – Advanced Robotics and Enabling Digital Technologies and Systems**
- **Angelini Holding S.p.A**

GRANTS

RESEARCH FUNDING

2025 was a very dynamic year for the Grants Area: new scientific projects were funded, others were completed, and project results contributed to the advancement of research by generating new knowledge, developing innovation, and fostering scientific breakthroughs that often go beyond the initial scope of the study.

In particular, this year, the highly competitive scientific activity in the field of cardiology has received once again significant recognition with the award of three important grants, scheduled to begin in early 2026: **the second ERC PoC titled "HemoStratum"**, aimed at developing a bioengineered substrate that uses the combination of microfibers and mesoscopic patterns to promote endothelial cell proliferation and their structural organization; a **project, led by the AOP of Friuli Venezia Giulia**, which, through the integration of omics and clinical data, aims to personalize the treatment of acute and chronic rejection in heart transplant patients; and finally, with the support of the Ministry of Economy and Made in Italy, the **STRIKE project** was funded under the highly competitive STEP Programme (Strategic Technologies for Europe Platform). The project aims to develop a platform for the clinical assessment of thrombotic risk in patients with Atrial Fibrillation, based on a risk index correlated to the morphology of the Left Atrial Appendage.

2025 also saw significant infrastructure interventions, such as the launch of the **CASTOR&POLLUX project**, aimed at strengthening the current Genomics/Transcriptomics laboratory with the equipment needed to extract genetic material from single cells and the installation of a server dedicated to processing and storing the acquired data. In terms of extra-EU cooperation, 2025 marked the opening to North Africa, with the award of the BIOGEN4MED project, funded by the INTERREG VI-A NEXT Italy–Tunisia Cooperation Program.
The project involves the collaboration of several Italian and Tunisian institutions working together to identifying and validating molecular biomarkers associated with high-impact oncological diseases, such as pancreatic adenocarcinoma and breast cancer, through the integrated use of advanced omics methodologies (proteomics, genomics, and other high-dimensional technologies). This project represents an additional contribution to the oncology research landscape, which is currently experiencing a period of significant growth and consolidation at Ri.MED.

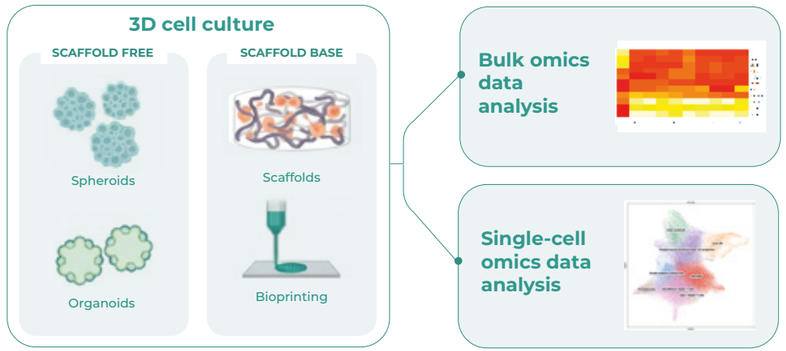
At the close of 2025, Ri.MED became a supporting member of **APRE**, the Italian National Contact Point for EU research programs, granting access to essential information, training modules, tools, and networks at both national and European levels, and reinforcing Ri.MED's capacity to participate successfully in EU funding initiatives.

A year marked by new collaborations, expanded networks, and prestigious recognitions, underscoring the excellence of the scientific research carried out at Ri.MED and reinforcing its competitiveness in major funding programs.

GRANTS

FOCUS ON

Addressing the complexity of cell-cell interactions through advanced bioinformatics systems



Graphical abstract of the project CASTOR&POLLUX

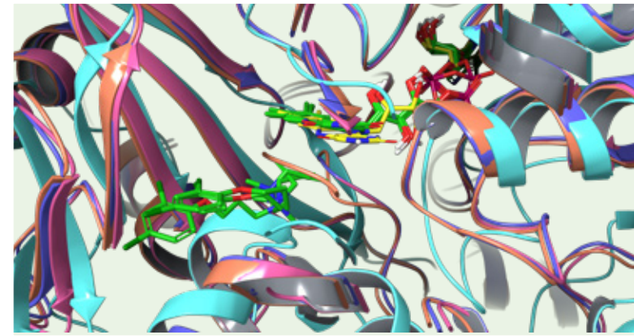
Cellular functions and organismal development depend on cell–cell interactions and the integration of microenvironmental signals through intracellular networks. Disruption of these processes can lead to disease. To better address this complexity, research increasingly relies on 3D cell models for more physiologically relevant systems, multi-omics approaches for integrated analysis, and single-cell technologies to achieve higher resolution than bulk methods and improve understanding of genotype–phenotype relationships.

Within this context, **CASTOR&POLLUX** was conceived. The project, coordinated by Claudia Coronnello (Principal Investigator in Advanced Data Analysis), is funded by the D34Health Programme (Digital Driven Diagnostics, Prognostics, and Therapeutics for Sustainable Healthcare) under the National Plan for Complementary Investments to the NRRP, cascade call, Spoke 4 "Biological and bioengineered *in vitro* models for care through Digital Twin approaches". The project began in January 2025 and aims to develop an advanced platform for generating and analyzing multi-omics data by integrating existing and newly acquired experimental and computational resources at the Ri.MED Foundation.
The project encompasses genomics, metagenomics, epigenomics, and transcriptomics analyses on single cells and bulk samples of 2D or 3D cultures, using Illumina and Oxford Nanopore sequencing technologies, according to specific biological needs. It enabled the acquisition of the Chromium X system from 10x Genomics for single-cell library preparation and two high-performance computing workstations for bioinformatics analysis.
Internal collaboration with Maria Giovanna Francipane (Principal Investigator in Regenerative Medicine) and Ugo Perricone (Group Leader in Molecular Informatics) contributes expertise in cholangiocyte organoids and automated workflows development, respectively.
The project also established collaborations with the Polytechnic University of Turin for omics analysis of 3D skin models and with Aizoon Consulting for the development and sharing of genomic analysis pipelines.

Overall, the project has successfully established a state-of-the-art infrastructure that integrates experimental and computational resources, enabling high-resolution multi-omics analyses on both bulk and single-cell samples. The acquisition of advanced technologies, the recruitment and training of three new fellows, combined with strategic collaborations, has significantly strengthened Ri.MED's capacity to generate, process, and analyze complex datasets. These achievements position the Foundation at the forefront of computational and experimental research, fostering deeper insights into cellular and microenvironmental dynamics and enhancing the robustness and scalability of its bioinformatics strategies.

FOCUS ON

Early Drug Discovery to identify novel inhibitors of Prenylcysteine oxidase 1 (PCYOX1), a novel target in cardiology and oncology



Close-up on binding site of MONOAMINO OXIDASE protein (PDB IDs: 1O5W, 2BXR and 2BXS) superimposed on human PCYOX1 generated model

Led by the European Oncology Institute (IEO) in Milan, this synergistic project is developed in collaboration with Ri.MED Foundation, Centro Cardiologico Monzino and ISMETT, Palermo. Maria De Rosa, PhD (Principal Investigator in Medicinal Chemistry) is responsible for the scientific coordination of the project and works in close collaboration with Ugo Perricone, PhD (Group Leader in Molecular Informatics), together with their teams at Ri.MED Foundation.

A cornerstone of the scientific literature to date shows that **PCYOX1** is a candidate target in cardiovascular and metabolic disorders. Previous evidence from the project team indicates that PCYOX1 is associated with plasma lipoproteins, primarily pro-atherogenic VLDL and LDL, and that its pro-oxidant activity contributes to the generation of reactive oxygen species, which play a role in the development of atherosclerotic plaques. PCYOX1 has also been shown to be a key regulator of adipogenesis. Moreover, preliminary findings show that PCYOX1 is critical for tumor cells to acquire a pro-metastatic phenotype both *in vitro* and *in vivo*.

Collectively, these evidences pose PCYOX1 to be a compelling target across multiple prevalent diseases. Through a multidisciplinary approach the project aims at validating the druggability of PCYOX1 and laying the base for future development of cardiovascular and anticancer therapeutics.

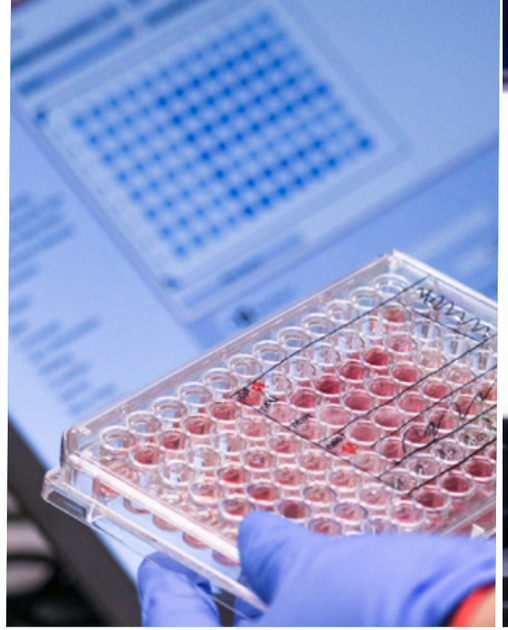
Ri.MED teams are working for the generation and optimization of computational models of the human PCYOX1 protein, whose experimental crystal structure is not yet available, to enable structure-based virtual screening (VS) campaigns. Initial activities focused on the development of reliable 3D models using complementary computational approaches, including homology modelling, threading techniques, and artificial intelligence-based methods. The optimized in-house model was validated using the only two known reference compounds to assess and rationalize their binding modes. VS campaign(s) will help with the identification of preliminary hits to be experimentally validated in biological assays developed by the partners. The most promising hit(s) will enter an iterative medicinal chemistry program—comprising rational design, synthesis, and *in vitro* biological evaluation—supported by *in silico* tools to guide structure–activity relationship (SAR) studies during the hit expansion and structure optimization process. The ultimate goal of the project is the identification of lead compound(s) with enhanced potency and drug-like properties for potential progression toward preclinical development.

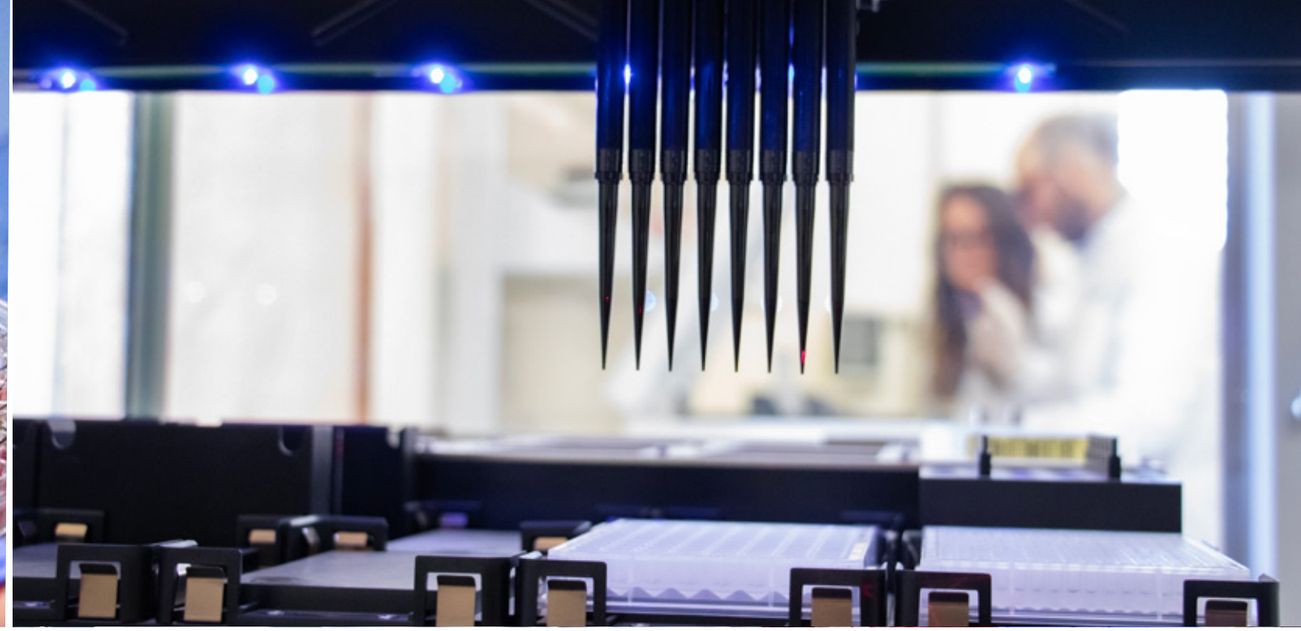
Invited to join this project for its recognized expertise, Ri.MED is uniquely positioned within a highly translational framework, enabling the group to consolidate and expand its expertise in structure-based drug design and medicinal chemistry, while fostering high-impact collaborations with leading clinical partners.

GRANTS

2025 ONGOING SCIENTIFIC PROJECTS

PROJECTS IN PARTNERSHIP WITH SCIENTIFIC AND/OR HEALTH CARE INSTITUTIONS AND SMs/BIG ENTERPRISES





National Biodiversity Future Center

Funding Agency/Programme: Ministry of University and Research. National Recovery and Resilience Plan (NRRP) - Mission 4 (Education and Research), Component 2 - Investment 1.4.
Objective:promoting the sustainable management of Italian biodiversity in order to improve the planet's health and return beneficial effects, essential for all people. Specific objective in the health sector is the exploitation of natural products for therapeutic scopes.
Click here for more information

National Center for Gene Therapy and Drugs based on RNA Technology

Funding Agency/Programme: Ministry of University and Research. National Recovery and Resilience Plan (NRRP) –Mission 4 (Education and Research), Component 2 - Investment 1.4.
Objective: increasing the technological know-how necessary to design and deliver RNA-based and gene therapy medicinal products and identifying promising candidate drugs/genes in five major areas of human diseases (genetic diseases, cancer, metabolic/cardiovascular diseases, neurodegenerative disorders and inflammatory/infectious diseases).
Click here for more information

NABUCCO
NUovi fArmaci e Biomarkers di risposta e resistenza farmaCologica nel Cancro del colon rettO (New drugs and biomarkers for response and pharmacological resistance in colon cancer)

Funding Agency/Programme: Innovation Agreement - Ministry of Enterprises and Made in Italy.
Objective: the NABUCCO project aims to develop innovative approaches for the diagnosis, risk stratification, and treatment of colorectal cancer, integrating advanced biotechnology, bioinformatics, and pharmaceutical development. The goal is to identify new therapeutic targets, optimize existing drugs, and develop predictive biomarkers of response and resistance to treatments, thus improving the efficacy of personalized therapies to increase patients' survival and quality of life.
Click here for more information

RADIATIONS
Studio e valutazione dell'effetto RADiobiologico di nanopartIcelle polimeriche innovative di origine nATurale radiomarcate con radioIsotopO Lu-177 in linee cellulari di caNcro della proStata

Funding Agency/Programme: Ministry of University and Research. Innovation Ecosystem "THE – Tuscany Health Ecosystem". National Recovery and Resilience Plan (NRRP). Cascade call managed by CNR-INO as Spoke 1.
Objective: synthesis and radiobiological validation of natural-based polymeric nanoparticles and theranostic nanogel (NG) radiolabelled with Lutetium-177 (a beta radioisotope, suitable for both diagnosis and therapy scopes) in prostate cancer cell lines. The expected result is the development of innovative NPP/NG from the synthetic and biocompatibility, cytotoxicity and internalization point of view, as well as from a functional point of view (diagnosis and therapy for prostate cancer).
Click here for more information

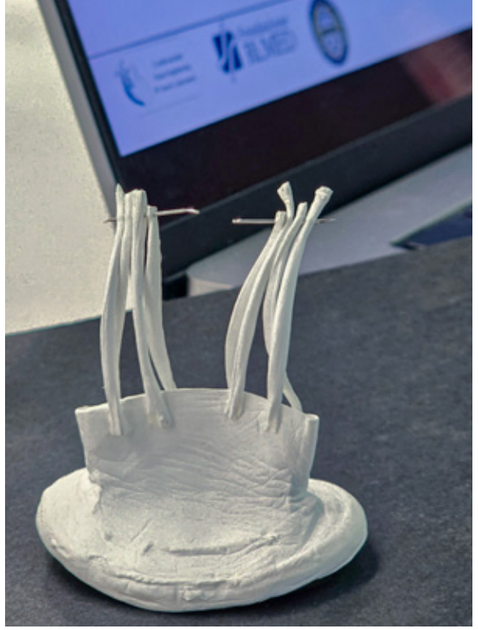
SmartSense
Smart testing device for personalized medicine based on nanostructured electrochemical biosensors

Funding Agency/Programme: Ministry of University and Research. Sicilian Micronanotech Research And Innovation Center – SAMOTHRACE (Innovation Ecosystem - cascade call - National Recovery and Resilience Plan (NRRP) - on behalf of the project Coordinator DI PIETRO GROUP srl.
Objective: Development of a prototype of a smart device for respiratory disease self-testing. The proposed device will provide support for disease monitoring through the measurement of hydrogen peroxide concentration in easily accessible biological fluids (saliva and exhaled breath condensate), using a nanostructured biosensor previously developed by the partnership. The device will also include data processing systems, as well as Internet of Things (IoT) communication functions to allow real-time transmission of data to healthcare personnel to facilitate disease monitoring.
Click here for more information

GRANTS

2025 ONGOING SCIENTIFIC PROJECTS

PROJECTS IN PARTNERSHIP WITH SCIENTIFIC AND/OR HEALTH CARE INSTITUTIONS



Exploiting the power of human induced pluripotent stem cell extracellular vesicles as a new anti- inflammatory drug for lung ischemia reperfusion injury

Funding Agency/Programme: Ministry of Health. National Recovery and Resilience Plan (NRRP) – M6/C2/I2.1.
Objective: assessing technical and commercial feasibility of an innovative cell-free nanomedicine strategy based on extracellular vesicles (EV), human induced pluripotent stem cells and a young cell source such as cord blood. The project is focused on a patent which highlights the strong anti-inflammatory role of EV isolated from cord blood mesenchymal stromal induced pluripotent stem cells.
Click here for more information

Benign and malignant esophageal stricture, an innovative approach to address an unmet clinical need: a biohybrid polymer - extracellular matrix, drug-eluting, esophageal prosthesis able to provide sustained mechanical support, actively prevent re-stenosis and induce constructive tissue remodeling

Funding Agency/Programme: Ministry of Health. National Recovery and Resilience Plan (NRRP) – M6/C2/I2.1.
Objective: iapproximately 35% of patients who have undergone surgery to address esophageal stenosis experience a recurrence of the condition. To reduce this risk, a biohybrid medical device will be developed using advanced tissue engineering technologies, able to provide sustained mechanical support, release active pharmaceutical ingredients, and deliver bioactive components derived from the extracellular matrix to induce constructive tissue remodeling.
Click here for more information

Life Science TTO Network – PerfeTTO

Funding Agency/Programme: Ministry of Health. National Plan for Complementary Investments to the NRRP – "Innovative Health Ecosystem" Program – Investment E.3.
Objective: establishing and consolidating a nationwide open and sustainable Technology Transfer Office (TTO) Network, which will connect, coordinate and align Network Partners and stakeholders (Research and Care Institutes (IRCCS), Universities, National Health System, Investors, SMEs, Industry, National and International Consortia) as well offer world-class services in a synergistic valuable way at national and international level.
Click here for more information

Early Drug Discovery to identify novel inhibitors of Prenylcysteine oxidase 1 (PCYOX1), a novel target in cardiology and oncology

Funding Agency/Programme: Ministry of Health. National Recovery and Resilience Plan (NRRP) – M6/C2/I2.1.
Objective: to validate the druggability of PCYOX1 and identify potential hit compounds directed against it for the future development of cardiovascular and anticancer drugs.
Click here for more information

PRISMA
Predizione del rischio di ischemia in fibrillazione atriale mediante machine learning (Prediction of ischemia risk in atrial fibrillation through machine learning)

Funding Agency/Programme: Ministry of University and Research. Innovation Ecosystem "THE – Tuscany Health Ecosystem". National Recovery and Resilience Plan (NRRP). Cascade call managed by Università degli Studi di Firenze as Spoke 2, 3, 5.
Objective: PRISMA aims at developing a telemedicine platform based on machine learning to improve the stratification of thromboembolic risk in patients with atrial fibrillation. The system will integrate synthetic models of the left atrial appendage, anatomical-physiological and fluid-dynamic parameters. It will employ neural networks to provide a personalized risk assessment, supporting the selection of the optimal therapeutic approach and promoting precision medicine.
Click here for more information

CASTOR&POLLUX
Centro per acquisizione, storage ed elaborazione dati da piattaforma multiomica per modelli cellulari tridimensionali (Centre for data acquisition, storage and processing from multiomic platform for three-dimensional cellular models)

Funding Agency/Programme: Ministry of University and Research. D34Health – Digital Driven Diagnostics, prognostics, and therapeutics for sustainable Healthcare – National Plan for Complementary Investments to the NRRP. Cascade call managed by Spoke 4 – "Biological and bioengineered *in vitro* models for care through Digital Twin approaches", Politecnico di Torino.
Objective: to enhance the current Genomics/Transcriptomics laboratory with the necessary equipment for extracting genetic material from a single cell and install a dedicated server for processing and storing acquired data. Standardized experimental protocols will be developed for the creation and sequencing of DNA or RNA libraries for bulk and/or single-cell analysis, as well as computational protocols for appropriate bioinformatics analyses.
Click here for more information

BioChord
Biomimetic engineered chordae tendineae for valve repair and regeneration

Funding Agency/Programme: European Commission Call ERC-2023-POC (Proof Of Concept).
Objective: to develop better Mitral Valve repair techniques that are simple, effective, and durable, further advancing and validating BioChord, the first ever polymeric bioengineered regenerative Chordae Tendinae, designed to first repair the MV by replacing the diseased CT.
Click here for more information

Complex graphical models for biological network science

Funding Agency/Programme: Ministry of University and Research - PRIN Call 2022 (Progetti di Ricerca di Rilevante Interesse Nazionale/ Research Projects of Relevant National Interest) on behalf of the project Coordinator Università degli Studi di Firenze.
Objective: collection and pre-processing of omics data and interpretation of results obtained by the novel statistical models developed within the project.
Click here for more information

SMART4SCLERO
Smart Injectable Scaffolds for Sclerostin Based Bone Resorption Treatment

Funding Agency/Programme: Ministry of University and Research - PRIN Call 2022 (Progetti di Ricerca di Rilevante Interesse Nazionale/ Research Projects of Relevant National Interest) on behalf of the project Coordinator Consiglio Nazionale delle Ricerche (Napoli).
Objective: developing an advanced *in vitro* model of joints' disorders dependent from bowel-related pathologies. The model will be based either on native than engineered tissues cultured in static, and dynamic conditions. These latter will be fabricated using the support of the bioprinting, as well as other additive manufacturing technologies.
Click here for more information

Green MID-PLACE
Green MIcrofluiDic PLAtform for advanced tissue on a Chip culturEs

Funding Agency/Programme: Ministry of University and Research - PRIN Call 2022 (Progetti di Ricerca di Rilevante Interesse Nazionale/ Research Projects of Relevant National Interest) on behalf of the project Coordinator Università degli Studi di Palermo.
Objective: to develop an eco-sustainable Organ-on-Chip (OoC) platform for stem cell growth and differentiation.
Click here for more information

BIOGEN 4 MED
Découvrir de nouveaux biomarqueurs grâce à la pharmaco-génomique pour une médecine de précision

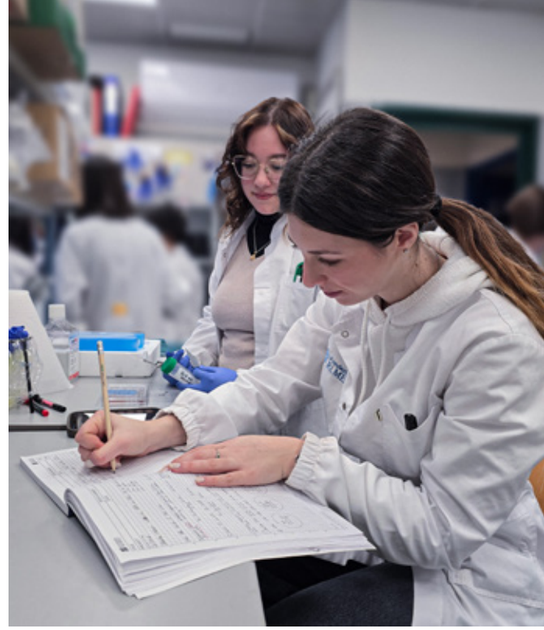
Funding Agency/Programme: Programma di cooperazione INTERREG VI-A NEXT Italia Tunisia
Objective: identification and validation of molecular biomarkers associated with high-impact oncological diseases, particularly pancreatic adenocarcinoma and breast cancer, through integrated application of advanced omics technologies—including proteomics and genomics.
Click here for more information

BIOMITRAL
Engineering the mitral valve: bioinspired control of structure and function for enhanced *in vivo* performance

Funding Agency/Programme: European Commission HORIZON 2020 – ERC Consolidator Grant (ERC-2020-COG).
Objective: developing an innovative prototype of a mitral valve by engineering the chordal apparatus and reconnecting the left ventricle with the valve leaflets.
Click here for more information

PHD JOINT DOCTORAL SCHOLARSHIPS ACTIVATED IN 2025

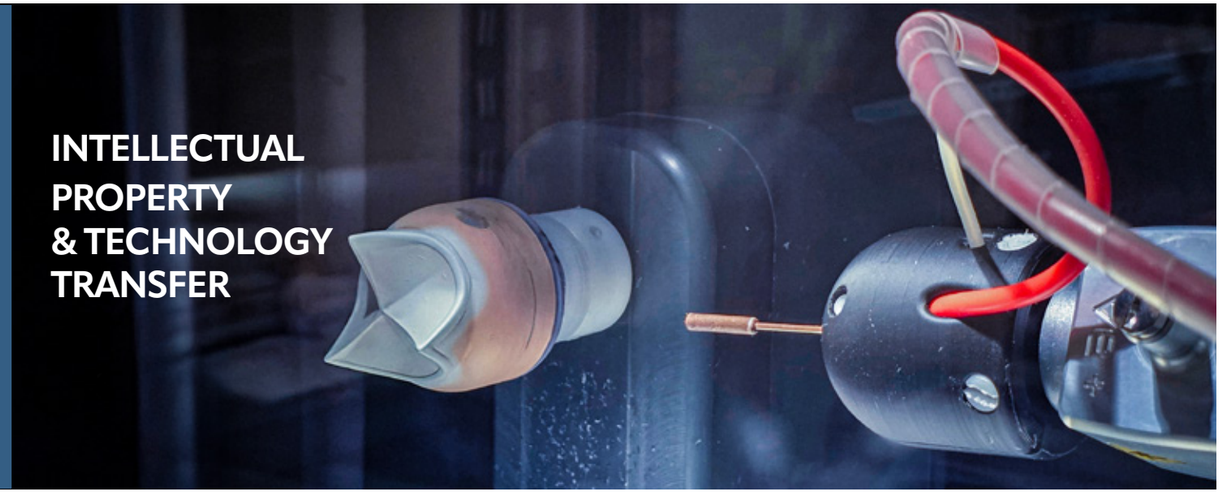
in partnership with Universities (Academic Year 2025/2026 – Cycle XLI) and visiting from PhD students from abroad



In the field of advanced scientific education, and in particular PhD programs, in 2025 the Ri.MED Foundation participated in the launch of joint doctoral scholarships with Italian Universities within 41st cycle (Academic Year 2025/2026). In some cases, these scholarships were funded through the second call of the Sicilian Regional Operational Programme (ROP) ESF+ 2021/2027; in other cases, Ri.MED fully financed the scholarships with its own resources. Below the list of joint doctoral programs for the 41st cycle.

SOURCE OF FUNDING

Public call for proposal n. 15/2024 (DDG n 826 del 16/04/2025), Sicilian Regional Operational Programme - European Social Fund + 2021/2027, joint scholarship with the University of Palermo:	n. 1 scholarship within the PhD program in Molecular and Clinical Medicine; n. 1 scholarship within the PhD program in Biomedicine Neuroscience and Advanced Diagnostics; n. 2 scholarships within the PhD program in Chemical, Environmental, Biomedical, Hydraulic and Materials Engineering; n. 1 scholarship within the PhD program in Quantum Artificial Intelligence.
Institutional funds of the University of Palermo recognized by the Italian Ministry of University and Research (MUR):	n. 1 scholarship within the PhD program in Mechanical, Manufacturing, Management and Aerospace Innovation.
Institutional funds of Ri.MED Foundation:	n. 1 scholarship within the PhD program in Technologies and Sciences for Human Health; n. 1 scholarship within the PhD program in Molecular and Clinical Medicine; n. 1 scholarship within the PhD program in Quantum Artificial Intelligence; n. 1 scholarship within the PhD program in Metabolic syndrome: from integrative biology to clinical transaction in One Health perspective
Indian Institute of Technology Kharagpur:	PhD student on a visiting program at Ri.MED from School of Medical Science and Technology, Department of Mechanical Engineering - Indian Institute of Technology Kharagpur (INDIA).



INTELLECTUAL PROPERTY & TECHNOLOGY TRANSFER

Ri.MED's research activity is strongly patient oriented, but in order to ensure that scientific results reach clinical needs, it is necessary to effectively manage the intellectual property generated by our researchers as well as the subsequent technology transfer process.

From the laboratories, inventions are translated into patents and then into new solutions for the patients. The protection of intellectual property is a fundamental value for Ri.MED to develop an innovative model of research sustainability.

For this reason, Ri.MED has set up an Intellectual Property and Technology Transfer Office to support, promote and foster the progress of translational research through the enhancement of its application effects: patenting, patent license, industrial sponsorship and creation of technological spin-offs.

Ri.MED and a multinational company operating in the cardiovascular area have recently finalized an important license and collaboration agreement having as object Ri.MED's patent family "Triskele" and that is still in full force. This patent family consists of a heart valve prosthesis, a heart valve and their related delivery system and one of the inventors is Gaetano Burriesci, Ri.MED group leader in Bioengineering and Medical devices.

A further crucial step in the valorization of Ri.MED's intellectual property was the conclusion of a license agreement with Neoolife Inc., a startup company founded to commercialize the joint intellectual property of Ri.MED/UPITT, protected by 6 patents (one developed in collaboration with the University of Cincinnati) and focused on technology for the development of regenerative heart valves. In 2023, Neoolife and a world-leading company in the sector entered into an ongoing agreement aimed at this development.

NEOLIFE
INNOVATIVE BIOMEDICAL TISSUE

FOCUS ON

PerfeTTO

Italian Technology Transfer Office Network in Life Science

Ri.MED is a partner of PerfeTTO, the Italian Technology Transfer Office Network in Life Science. The project, funded by the Ministry of Health through the Complementary National Plan (PNC) to the National Recovery and Resilience Plan (PNRR), brings together 54 centers of excellence across Italy, such as Research Hospitals (IRCCS - Scientific Institutes for Research, Hospitalization, and Care), prestigious Universities, and both public and private Research Institutes.

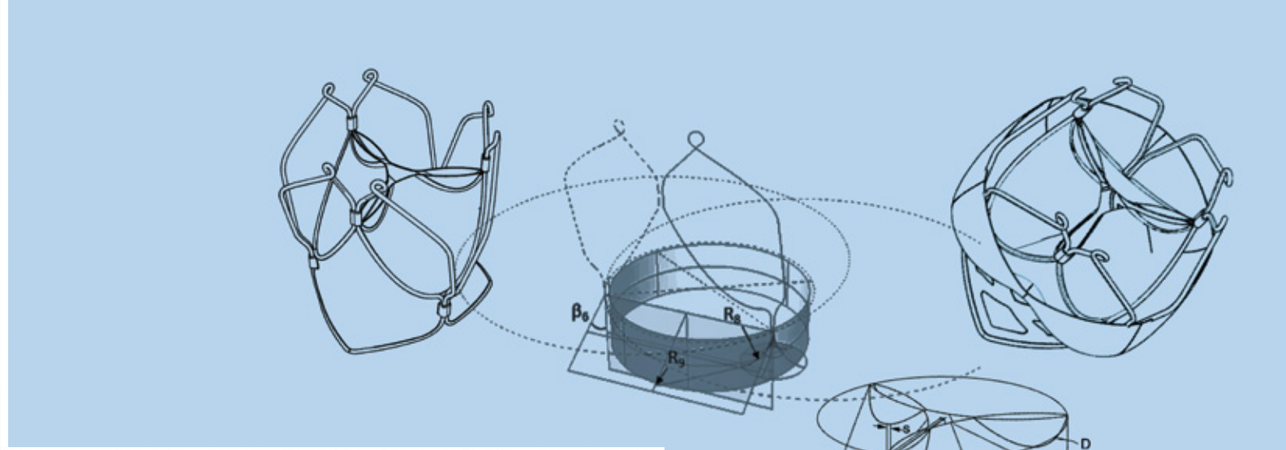
By being part of this ecosystem, Ri.MED Foundation joins a national effort to harmonize procedures and share resources for the protection and commercialization of scientific discoveries.

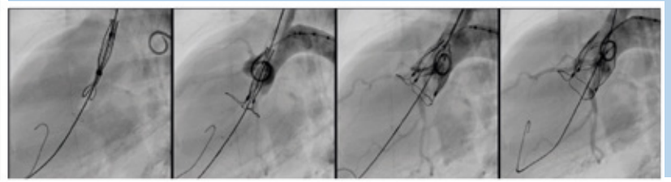
This partnership allows Ri.MED to grow its networking connections, access advanced tools for Technology Transfer, and promote its patents through the PerfeTTO Technologies Portfolio, a collection of technologies promoted at major industry trade fairs.

In 2025, a representative of Ri.MED took part in BIO-Europe Spring 2025, in Milan, as part of the PerfeTTO delegation. During the event, within the PerfeTTO framework, Ri.MED was able to gain significant visibility before a global audience. By integrating its scientific excellence with the national strength of the PerfeTTO network, Ri.MED continues to drive innovation and foster strategic partnerships.

INTELLECTUAL PROPERTY & TECHNOLOGY TRANSFER

PATENT PORTFOLIO
UP TO 31.12.2025





DRUG DISCOVERY

Nitro-oleic acid controlled release platform to induce regional angiogenesis in abdominal wall repair
WO2019100021
Fondazione Ri.MED - University of Pittsburgh

Novel reversible nitroxide derivatives of nitroalkenes that mediate nitrosating and alkylating reactions
WO2018067709
University of Pittsburgh*

REGENERATIVE MEDICINE AND IMMUNOTHERAPY

NK-mediated immunotherapy and uses thereof
WO2018099988
Fondazione Ri.MED - IRCCS ISMETT

Extracts for the regeneration of ligaments
PCT/US2019/019119
Fondazione Ri.MED - University of Pittsburgh

Method of Producing Regulatory Dendritic Cells
US Provisional n. 63/504,494
Fondazione Ri.MED/IRCCS ISMETT/University of Pittsburgh

Kit per la Ricostituzione di un Dispositivo Biomedico Cell-Free ad Uso in Medicina Rigenerativa, Dispositivo Biomedico Così Ricostituito e Relativo Procedimento di Sintesi
ITA N. 102023000019479
Fondazione Ri.MED/IRCCS ISMETT

Italian patent application filed in March 2025 related to prostetic biliary duct
Applicants: Fondazione Ri.MED

TISSUE ENGINEERING AND BIOMEDICAL DEVICES

Method and system for the evaluation of the risk of aortic rupture or dissection in an ascending thoracic aortic aneurysm
WO2018220573
Fondazione Ri.MED - IRCCS ISMETT

Transatrial access for intracardiac therapy
WO2017127682
University of Pittsburgh*

Bi-layer extra cellular matrix scaffolds and uses thereof
WO2017044787
University of Pittsburgh*

Multi-layered graft for tissue engineering applications
WO2019023447
Fondazione Ri.MED - University of Pittsburgh

Treating soft tissue via controlled drug release
WO2015134770
University of Pittsburgh*

Microfluidic Tissue Development Systems
WO2017062629
University of Pittsburgh*

A modular, microfluidic, mechanically active bioreactor for 3D, multi-tissue, tissue culture
WO2015027186
University of Pittsburgh*

Organ chip to model mammalian joint
U.S. Patent Appl. No. 16/193,972
University of Pittsburgh*

Osteoarthritis treatment with chemokine-loaded alginate microparticles
U.S. Patent Appl. No. 16/241,112, continuation application of WO2014022685
Fondazione Ri.MED - University of Pittsburgh

Recruitment of mesenchymal stem cells using controlled release systems
WO2014022685
University of Pittsburgh*

Multi-well mechanical stimulation systems and incubators
WO2019079722
Fondazione Ri.MED - University of Pittsburgh

An expandable percutaneous cannula
PCT/US2018/017795
Fondazione Ri.MED - University of Pittsburgh

Processing method and apparatus for micro-structured rope-like material
US provisional Patent Application 62/874,114
Fondazione Ri.MED - University of Pittsburgh

Semi-rigid annuloplasty ring and method of manufacturing
WO2019220365
Fondazione Ri.MED

Heart valve prosthesis
WO2010112844
Fondazione Ri.MED

Prosthesis delivery system
WO2012052718
Fondazione Ri.MED

Prosthetic heart valve
WO2016203241
Fondazione Ri.MED

Implant for heart valve repair
WO/2022/229667
Fondazione Ri.MED - Université de technologie de Compiègne - Centre National De La Recherche Scientifique (CNRS) - Assistance Publique/Hôpitaux De Paris

Dispositivo Medico Impiantabile
ITA n. 102023000010848
Fondazione Ri.MED/ University of Pittsburgh

Implantable Composition for Use in Cartilage Defects Repair in Postsurgery Rehabilitation
PCT/EP2023/065364
Fondazione Ri.MED – CHOP (Children's Hospital of Philadelphia)

Italian patent application filed in November 2024 related to design and realization of an active bioscaffold for the regeneration of hyaline cartilage in articular joints
Applicants: Fondazione Ri.MED – CHOP – UNIPA

NOTE:

* *Also patents where University of Pittsburgh is the only applicant have been co-developed with Ri.MED.*

6 further University of Pittsburgh-Ri.MED patents in the field of tissue engineering are licensed exclusively to the startup Neoolife Inc.

Ri.MED RESEARCH CENTER

SOCIO-ECONOMIC IMPACT

The state-of-the-art center that the Foundation is building in Sicily, just a few miles from Palermo International Airport, is set to become a reference point for researchers from around the world. The **Ri.MED Research Center** represents a strategic turning point for Sicily and for the country as a whole. The overall investment, amounting to approximately €250 million, will help activate major infrastructure and high-tech value chains in the area, generating direct, indirect, and induced economic effects and acting as a development multiplier for the metropolitan area of Palermo and the Sicilian Region.

The campus will also host a **business incubator**, designed to support the creation and development of innovative start-ups in the biomedical and biotechnology sectors, contributing to the development of a true innovation ecosystem. The center will foster the creation of highly qualified employment opportunities, attract talent, and strengthen the region's scientific and technological ecosystem.

The center's scientific approach is based on the "**One Health**" paradigm, which integrates human health with environmental protection. By studying the interactions between the environment, genetics, and key organs—such as the heart, lungs, and brain—research activities are placed within a broader framework that also considers the health impact of global factors such as climate change, pollution, antimicrobial resistance, and mental health.

The project is inspired by the "**village street**" model and features a highly flexible spatial organization, with 17,070 square meters dedicated to laboratories, common areas, meeting rooms, offices, an auditorium, and a guest house. Particular attention has been given to environmental sustainability: the architecture of the center is designed to minimize its impact on the surrounding area, favoring the use of local materials, renewable energy sources, and full integration with the natural landscape, in close proximity to the Grotta dei Puntali Nature Reserve.

Since construction began in 2020, work on the Ri.MED Research Center has never been interrupted, despite the succession of global events—from the COVID-19 pandemic to subsequent geopolitical tensions—that have affected the availability of building materials and project timelines. More recently, the Foundation faced a particularly complex phase related to contractor difficulties. Thanks to careful oversight and constant supervision, project continuity has been ensured: civil works have now exceeded **70% completion**, while installations and technological equipment are well underway.

Ri.MED RESEARCH CENTER

INTEGRATION WITH HEALTHCARE

The challenge in Life Sciences increasingly lies in the ability to quickly translate scientific research into clinical applications. This requires an effective integration of complementary resources and skills: from basic research to the preclinical development of new therapies and medical devices, biomarkers, and clinical trials.

Since 2017, the Ri.MED Foundation has been part of the corporate structure of ISMETT IRCCS, establishing a unique model in Sicily that combines biomedical research with highly specialized clinical care. This collaboration enables the rapid application of research results to patient care, ensuring continuous synergy between clinicians and researchers.

The upcoming Ri.MED Research Center in Carini, together with the new ISMETT Hospital, designed by Renzo Piano, will create a world-class hub uniting basic research, the development of innovative therapies, and top-level clinical care. The new hospital will feature 253 beds, including 36 intensive care units and 217 convertible to sub-intensive care, and will be fully integrated into a shared translational ecosystem with Ri.MED.

This strategic integration enhances the potential of research, accelerates the delivery of scientific innovations to patients, and generates positive impacts on the local economy and regional development. By connecting discoveries in basic research to clinical applications, the Ri.MED–ISMETT partnership produces high-value outcomes for patient care, innovation, and the growth of Sicily and Italy as a whole.

The project of an integrated center for research and highly specialized care also confirms the **strategic collaboration between UPMC, ISMETT, and Ri.MED.** Integrating complementary skills increases the potential for scientific success and improves competitiveness for research funding. In line with this, and given the growing number of joint projects, “The cluster” activities with shared objectives have been identified to maximize collaboration.

Already, numerous joint research initiatives are underway, making Ri.MED and ISMETT/UPMC a leading example of excellence in the synergy between research, innovation, and clinical practice.

Ri.MED RESEARCH

Ri.MED's research program is structured into three strategic therapeutic areas: Drug Discovery focused on the identification and validation of novel therapeutic targets, as well as the development of small molecules and biologics; Regenerative Medicine and Immunotherapy, with a particular emphasis on the development of cell-based therapies and Advanced Therapy Medicinal Products (ATMPs); Tissue and Biomedical Engineering dedicated to the design and production of innovative biomaterials, bioengineered tissues, and advanced medical devices.

Ri.MED's activities cover the full translational pathway, ranging from the discovery and functional characterization of biologically active molecules and subsequent lead optimization; through the development of cell-based therapies and advanced organotypic and three-dimensional models for disease modeling and therapeutic assessment; to the development of next-generation implantable devices and engineered tissue constructs intended to restore, replace, or enhance physiological function.

Research priorities are guided by clearly defined therapeutic needs, ensuring close alignment between scientific innovation and clinical application. This integrated bench-to-bedside approach is enabled by state-of-the-art technological platforms and supported by a multidisciplinary team of scientists and clinicians working toward shared translational and product development objectives.

DRUG DISCOVERY

STRUCTURAL BIOLOGY AND BIOPHYSICS
MOLECULAR INFORMATICS
MEDICINAL CHEMISTRY
EXPERIMENTAL LUNG RESEARCH
PROTEOMICS
ADVANCED DATA ANALYSIS
IMAGING AND RADIOMICS

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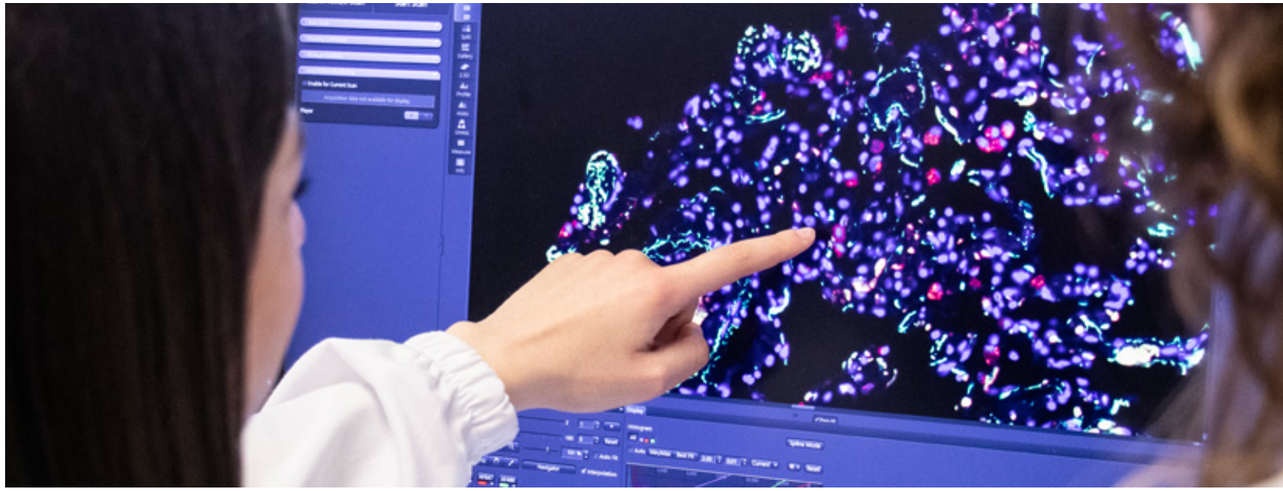

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STRUCTURAL BIOLOGY AND BIOPHYSICS

FOCUS

- Identification of new therapeutic targets
- Biophysical and structural studies for the discovery of new therapeutic candidates for preclinical studies
- Structure determination of proteins and protein complexes
- Implementation of NMR-based diagnostic tools

AIMS

- Unravel molecular mechanisms behind human diseases
- Develop novel preclinical candidates for unmet medical needs
- Contribute to defining the next generation of therapeutic treatments
- Facilitate the creation and consolidation of local biotech companies
- Contribute to consolidating Structural Biology in Southern Italy and the Mediterranean Area

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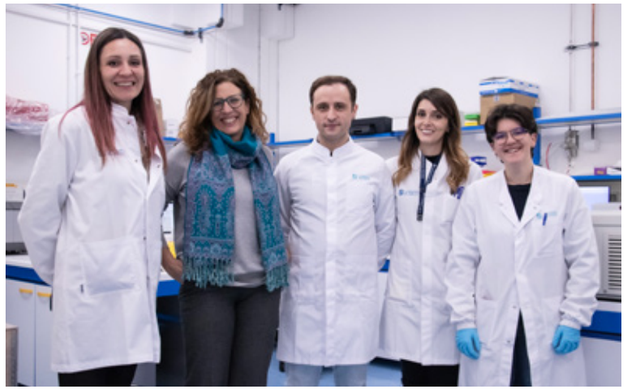

Understanding the folding dynamics, phase transitions, and interactions of proteins – both among themselves and with small molecules and nucleic acids – is essential for uncovering the molecular mechanisms driving key biological phenomena involved in both physiological and pathological processes. Our group focuses on deciphering these processes using an array of experimental structural and biophysical techniques, including high-field nuclear magnetic resonance, circular dichroism, isothermal titration calorimetry, interferometry, and fluorescence spectroscopy, complemented by molecular biology and computational approaches. These approaches allow us to investigate the kinetics and thermodynamics of biological phenomena and provide mechanistic details at the atomic level.

A primary focus of our research is the study of the molecular mechanisms leading to proteins' self-assembly and formation of amyloid-like aggregates, which play a pivotal role in neurodegenerative disorders. Current treatments for these conditions are largely palliative and non-specific, reflecting gaps in the understanding of the disease's molecular basis. Our research aims to unravel the mechanisms of protein misfolding and aggregation behind neurodegenerative diseases and deepen our knowledge of the normal functions and interaction networks of aggregating proteins to design molecules capable of specifically inhibiting pathological aggregation.

Another key project within the group focuses on mussel foot adhesive proteins (Mfps). Similar to proteins involved in neurodegenerative disorders, Mfps undergo a phase transition and form stable aggregates, but with remarkable adhesive properties. This feature makes Mfps of great interest for developing novel, naturally-derived adhesives for biomedical applications, such as tissue engineering, medical device implantation, and regenerative medicine. However, the molecular basis of Mfps adhesive capability remains poorly understood. Our goal is to elucidate these mechanisms at the atomic level to inform the development of innovative bio-adhesive materials able to work in wet environments.

In addition to these projects, our group is actively involved in small molecule-based drug discovery and the development of protein-based therapeutics, with a particular focus on therapeutic antibodies.

COLLABORATIONS

- Biophysics Institute of the National Research Council (IBF-CNR), Palermo, IT
- University of Palermo, Palermo, IT
- University of Campania "Luigi Vanvitelli", Naples, IT
- European Brain Research Institute (EBRI) Rita Levi Montalcini, Rome, IT
- King's College London, London, UK
- i3S - Instituto de Investigação e Inovação em Saúde, Universida de do Porto, Porto, PT

MOLECULAR INFORMATICS

FOCUS

- **Creation of molecular libraries for biological screening**
- **Computer-assisted molecular design for drug-like molecules**
- **Biological characterization of xenobiotics through computational tools**
- **Study of protein-protein interactions in biological processes**

AIMS

- **Gaining in-depth insight into the molecular mechanisms that drive the development of diverse diseases**
- **Designing innovative chemical and biological therapeutic agents tailored to specific pathological targets**
- **Developing predictive *in silico* models to accelerate the drug discovery pipeline and support informed toxicology decision-making**

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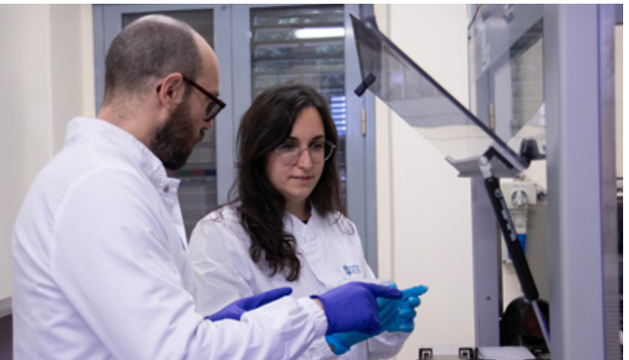

The Molecular Informatics group at the Ri.MED Foundation develops and applies *in silico* methodologies to support the design, characterization, and optimization of biologically active molecules. The group focuses on building robust predictive computational models to elucidate disease-related molecular mechanisms and guide the rational design of chemical and biological therapeutics. By integrating molecular modeling, virtual screening, and AI-driven chemoinformatics, the team leverages strong expertise in medicinal and computational chemistry for molecular library generation and Virtual screening campaigns. Collaborations with the Universities of Palermo, Verona, Paris, and Vienna have further strengthened AI-based activity prediction approaches.

In 2025, the group was involved in the following projects:

Design of chronic inflammation disease modulators.
State-of-the-art *in silico* tools, including artificial intelligence–based methodologies, were employed to analyze large-scale datasets, predict molecular interactions, and identify key molecular patterns associated with biological activity. The research integrates bioinformatics and chemoinformatics to identify novel compounds capable of modulating NLRP3 activity. In 2025, a hit family was successfully validated, leading to the initiation of a hit expansion campaign characterized by an iterative feedback loop between computational analyses and medicinal chemistry, where *in silico* insights continuously guided the rational design, prioritization, and optimization of new compounds.

Design of Prenylcysteine Oxidase 1 (PCYOX1) modulators.
In this project computational analyses elucidated the mechanism of known inhibitors to validate predictive models, later applied as a strategic support tool for the rational design of novel compounds in close collaboration with medicinal chemistry.

Development of a computational platform for xenobiotics BBB permeability assessment.
This project, in collaboration with ADA group, involves the development of a computational platform for predicting xenobiotic blood–brain barrier (BBB) permeability using machine learning models trained on large and curated datasets. In addition to prediction, the platform integrates explainable AI modules to identify the molecular descriptors and features driving BBB permeation, supporting model interpretability and informed optimization strategies.

Development of a machine learning tool for the prediction of small molecules activity as G quadruplex (G4) stabilizers.
With a focused interest in DNA and RNA G-quadruplex structures, the group leverages machine learning–driven computational models, validated by experimental assays, to guide the rational design of selective modulators. In 2025, in collaboration with the University of Palermo and Université Paris Cité, the group released the AGAPE platform to support the design of G4 stabilizers.

Development of an AI-based platform for Drug-Target Interaction.
Development of an AI-based platform for quantitative prediction of drug–target interactions, including interaction likelihood and binding affinity (Kd), integrating explainable AI modules to interpret model outputs and key molecular determinants.
Welcome to the Molecular Informatics Group – Where innovation and cutting-edge technology transform molecular research and accelerate discoveries!

COLLABORATIONS

- University of Vienna (Pharmaceutical chemistry department), Vienna, AT
- Italian National Council of Research (CNR), IT
- University of Verona, Verona, IT
- University of Paris Citè, Paris, FR
- University of Palermo, Palermo, IT

DRUG DISCOVERY

Ri.MED RESEARCH

MEDICINAL CHEMISTRY

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FOCUS

- Design and synthesis of new chemotypes
- Identification of new hit compounds
- Family hit expansion and structural optimization
- Structure-activity relationship (SAR) studies
- Hit-to-lead optimization
- Planning, set-up, optimization and scale-up of synthetic routes
- Retrosynthesis
- Structural characterization of new molecules
- Design and synthesis of new NLRP3 inhibitors
- Early drug discovery to validate prenylcysteine oxidase 1 (PCYOX1) as a novel target in cardiology and cancer

AIMS

- Early drug discovery toward therapeutic treatment of diseases
- Identify new potential target modulators

The research activities of the Medicinal Chemistry group focus on the discovery of new modulators of therapeutic targets of interest. The design, synthesis, and structural characterization of novel small molecules, peptides, and peptidomimetics are the main areas of expertise and lead to the creation of building block collections and compound libraries. One of the research projects deals with the identification of novel potential inhibitors of NLRP3 (NOD-, LRR- and pyrin domain-containing protein 3) inflammasome with heterocyclic structure. NLRP3 is an appealing target to cure chronic inflammation in age-related diseases (neurodegeneration, autoimmune disorders, etc.).

In 2025, we identified four indoles of *de-novo* design as moderate NLRP3 inhibitors. These compounds were able to selectively reduce NLRP3-dependent IL-1β release with micromolar inhibitory activity (in the range of 26-31 μM) in THP-1 cells, and were safe at the same concentrations; moreover, they inhibited the release of lactate dehydrogenase, the enzymatic activity of caspase-1 and ASC speck formation with a dose-response effect. Two derivatives showed to be the most promising and were able to inhibit IL-1β release in primary human macrophages. Furthermore, no off-target effects were observed as the compounds did not inhibit LPS-induced TNF release. *In silico* studies showed that this new class can accommodate the NACHT domain, making several interactions with crucial key residues of the protein. Target engagement assay confirmed a direct binding with NLRP3 NACHT domain (manuscript under review) in collaboration with Molecular Informatics and Experimental Lung Research groups.

In parallel, in collaboration with the Drug Discovery area, a small library of structural close analogues of the primary hits pyrimidine-structure based retrieved from a virtual screening campaign (by the Molecular Informatic group) were synthesized and the biological investigation is on the way (hit expansion and structure optimization studies).

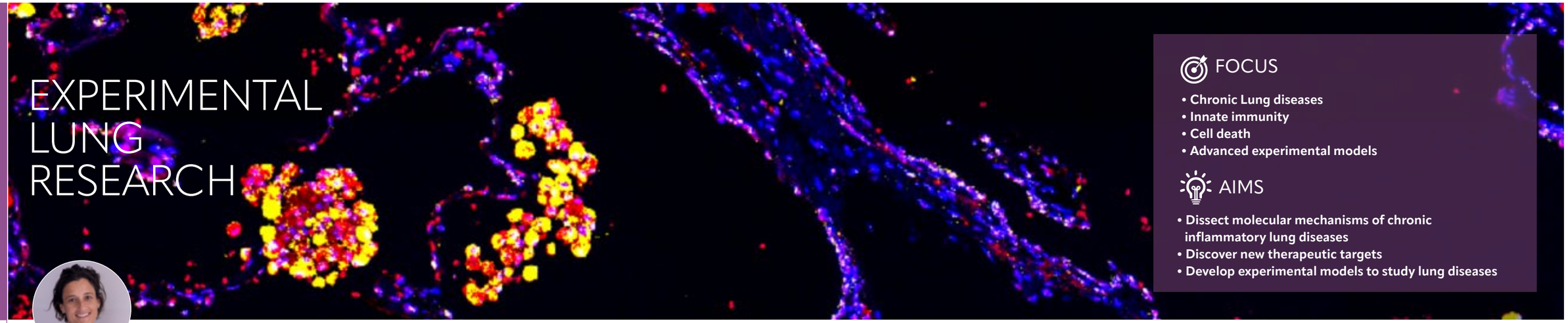
A second project of high interest concerns the validation of PCYOX1 as a novel target in cardiology and oncology, in collaboration with the European Institute of Oncology, Centro Cardiologico Monzino, and Istituto Mediterraneo per i Trapianti e Terapie ad Alta Specializzazione. Last year, the group designed and synthesized a small set of derivatives starting from the structure of the only two known ligands of PCYOX1. In preliminary studies on cardiovascular cell lysates, two compounds drastically reduced the level of hydrogen peroxide produced by PCYOX1, indirectly demonstrating the ability of our compounds to inhibit the protein. Further biological investigations on the biochemical assay and in cancer cells are ongoing. Meanwhile, the group is working on the synthesis of more derivatives. We published a peer-review perspective about bridged heterocycles and the unique features associated with their three-dimensional configuration.

Moreover, in collaboration with the Molecular Informatics group, we contributed to a manuscript entitled *In silico*-guided exploration of SIRT6 modulation: Discovery of new fragments hits inhibitors. Currently, the group is writing a perspective on applications of peptide-drug conjugates to overcome limits and drawbacks of drugs currently in clinic.

COLLABORATIONS

- European Institute of Oncology (IEO), Milan, IT
- Centro Cardiologico Monzino, Milan, IT
- The Mediterranean Institute for Transplantation and Advanced Specilaized Therapies (ISMETT-IRCCS), Palermo, IT
- CHIBIOPHARAM Dept. University of Messina, IT

EXPERIMENTAL LUNG RESEARCH



FOCUS

- **Chronic Lung diseases**
- **Innate immunity**
- **Cell death**
- **Advanced experimental models**

AIMS

- **Dissect molecular mechanisms of chronic inflammatory lung diseases**
- **Discover new therapeutic targets**
- **Develop experimental models to study lung diseases**

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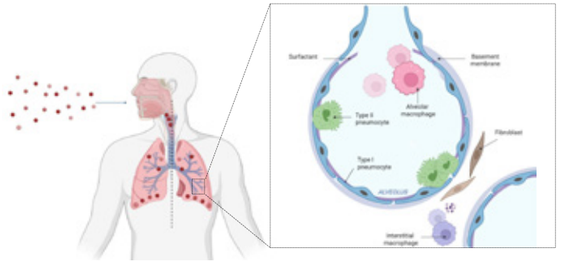
We study innate immunity in lung diseases, both in chronic conditions caused by exposure to external insults such as cigarette smoke as well as in acute settings such as infections. Under homeostatic conditions, alveolar macrophages are the most abundant myeloid cells in the alveolar space and play a key role in orchestrating first line host defenses.

Our research focuses on macrophage-associated immune responses. We are interested in studying how inflammasomes, caspases, and regulated cell death participate to inflammatory reactions in health and disease. In this respect, growing evidence suggests that fine-tuning cell death may provide a tool for treating chronic inflammation. In particular, we are interested in studying the impact of the pore-forming proteins gasdermins (GSDMs) on the surrounding inflammatory milieu. GSDMs are activated downstream of inflammatory and apoptotic caspases. Upon their activation, GSDMs move to the cellular membrane creating pores and allowing unconventional secretion of IL-1 family cytokines as well as of small damage-associated molecular patters (DAMPs).

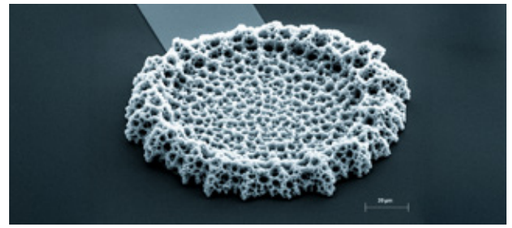
Recent evidence has shown that GSDMs can translocate to intracellular organelles such as mitochondria and endoplasmic reticulum and can be transferred to bystander cells via extracellular vesicles (EV).

We are currently investigating the impact of GSDMs pore formation on the release of cytosolic proteins in human macrophages and how this affect cellular cross-talk, in particular with lung fibroblasts and neutrophils. We are also investigating the impact of gasdermins on mitochondrial health and macrophage immunometabolism as well as their role in propagating cell death and inflammation via EV, in cigarette smoke-associated inflammation. A key asset of our lab is the availability and the continuous set-up of new experimental models using human primary cells that we isolate from buffy coats and lung resections. These experimental models are also used as a tool for the development and validation of innovative biosensors for monitoring oxidative stress and inflammation within a consolidated collaboration with the Engineering Department at the University of Palermo.

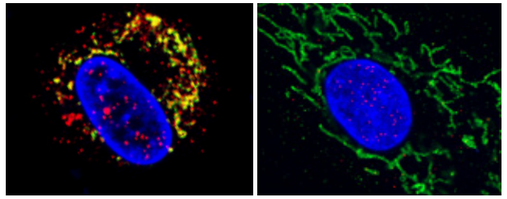
Our Lab is currently hosted by the National Research Council of Palermo and hosts the Screening Platform of the Ri.MED Foundation Drug Discovery Unit.



Impact of environmental exposure on airways innate immunity.



Microstructured gold foam deposited on a silicon microchip for immunosensor fabrication.



Mitochondrial network (green) and active Gasdermin D (red) in human macrophages exposed to cigarette smoke (left) or control (right).

COLLABORATIONS

- The Mediterranean Institute for Transplantation and Advanced Specialized Therapies (ISMETT-IRCCS), Palermo, IT
- University of Palermo, IT
- University of Messina, IT
- Institute of Translational Pharmacology (IFT) – National Research Council (CNR), IT
- Institute for Biomedical Research and Innovation (IRIB) – National Research Council (CNR), IT
- Institute for Lung Research, Philipps University Marburg, DE
- La Maddalena spa, Palermo, IT
- ARNAS Ospedali Civico Di Cristina Benfratelli, Palermo, IT

PROTEOMICS

FOCUS

- **Use high-resolution proteomics to identify novel substrates, and hence functions, of ADAMs and other proteases**
- **Utilize mass spectrometry-based approaches to investigate the functions of ADAM17 and its cofactors, iRhom1 and iRhom2**
- **Identify predictive and prognostic biomarkers for various clinical conditions, including post-transplant complications, through high-resolution proteomics**

AIMS

- **Identify novel functions of ADAM17 and iRhoms, and elucidate the molecular mechanisms underlying iRhom-mediated regulation of ADAM17 activity**
- **Discover molecular targets and biomarkers to advance healthcare solutions**
- **Develop and optimize proteomic methodologies to support studies of varying scales in health and biotechnology research**

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- University of Palermo, Palermo, IT
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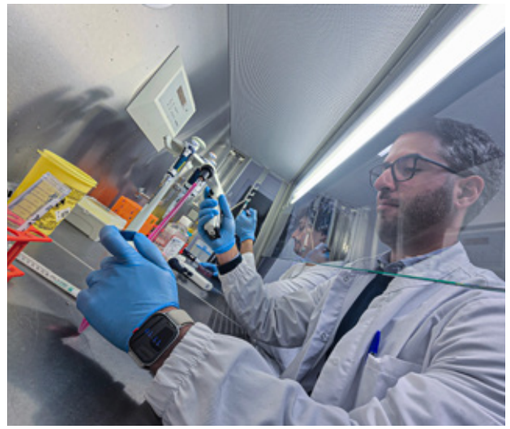
- University of Udine, Udine, IT
- Istituto Ortopedico Rizzoli, Bologna, IT
- German Center for Neurodegenerative Diseases (DZNE) Munich, DE
- Hospital for Special Surgery, Weill Cornell University, NY, US
- University of East Anglia, Norwich, UK
- University of Nottingham, UK
- University of Liverpool, UK
- Tokyo University of Agriculture and Technology, JP
- University of Sousse, TN

The Proteomics group is structured around two main research lines: the use of high-resolution proteomics to study a specific class of proteases, the ADAMs (A Disintegrin And Metalloproteinase), and the molecular mechanisms they regulate in different pathophysiological contexts; and the development and application of cutting-edge proteomics methodologies for the analysis of clinically derived biological fluids, aimed at identifying biomarkers for precision medicine across a range of diseases, including cancer, organ transplantation, and neurodegenerative disorders.



ADAM research

Owing to their ability to release proteins from the cell surface through ectodomain shedding, ADAMs are involved in numerous fundamental cellular processes, including cell–cell communication, cell adhesion, and the regulation of molecular transport. The laboratory employs an integrated approach combining quantitative proteomics, cell biology, biochemistry, and *in vivo* models to identify novel ADAM substrates and to define the cellular and pathophysiological functions controlled by these proteases. In particular, research activities are focused on characterizing previously unrecognized functions of ADAM17 and its essential cofactors, iRhom1 and iRhom2, using mass spectrometry–based approaches. A notable example of this work is the recent identification of an iRhom2-mediated mechanism regulating the maturation of MHC class I molecules, as well as the demonstration of how iRhom1 and iRhom2 modulate the ADAM17 sheddome, defined as the repertoire of protein substrates processed by this protease.

Clinical proteomics

The group has developed and optimized a range of methodologies for proteomic analysis of biological fluids obtained directly from patients. The integration of these protocols with Astral mass spectrometry—currently the most advanced system within the Orbitrap platform—has enabled unprecedented analytical depth in the study of biological fluids. These approaches have been successfully applied to the analysis of cerebrospinal fluid from patients with Alzheimer's disease, allowing the identification of diagnostic markers capable of discriminating between different forms of the disease, as well as to the analysis of biological fluids from organ transplant recipients.

This research line benefits from strong clinical collaborations at both the local level—particularly with ISMETT and the University Hospital of Palermo—and the national level, including partnerships with the University Hospital of Udine and Padova, the Rizzoli Orthopaedic Institute and Humanitas Rozzano, among others.

ADVANCED DATA ANALYSIS

FOCUS

- Multi-omics analysis of complex biological data
- Cancer and aging
- Short- and long-read NGS technologies
- Integration of molecular and clinical data
- Single-cell approaches and 3D models
- RNA-based therapeutic strategies

AIMS

- Extract biologically meaningful information from big data
- Develop customized computational analysis pipelines
- Characterize complex biological systems
- Investigate cellular heterogeneity and dynamics
- Support the development of RNA therapeutics

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COLLABORATIONS
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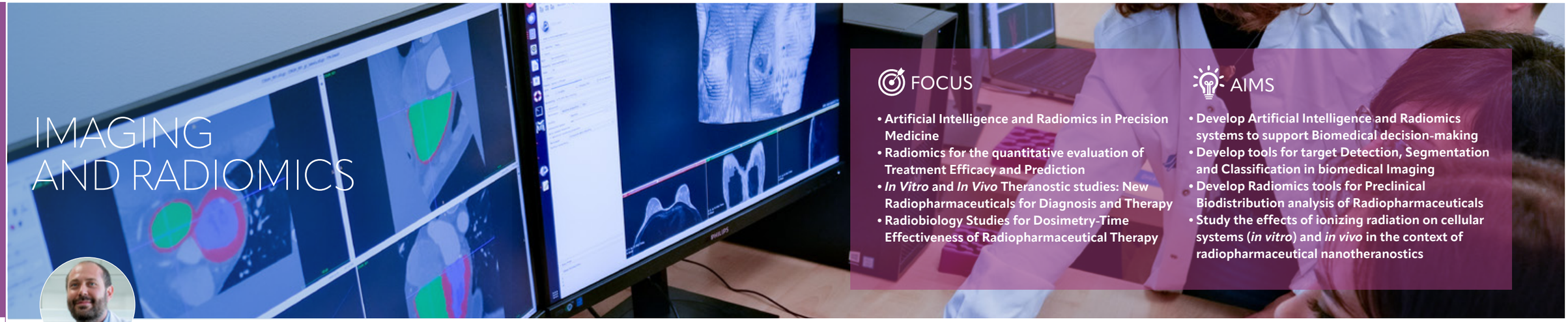
- Politecnico di Torino, Torino, IT
- Consiglio Nazionale delle Ricerche, IRIB, Palermo IT
- IGM, Pisa, IT
- IFC, Pavia, IT
- ISMETT – IRCSS, Palermo, IT
- Mitchell Center for Neurodegenerative Diseases, The University of Texas Medical Branch, US

The Advanced Data Analysis Group is dedicated to the development and implementation of experimental and computational methodologies aimed at extracting the maximum amount of information from complex biological models and scientific data. The group's activities lie at the intersection of biology, bioinformatics, and data science, with a strong focus on the integrated analysis of large and heterogeneous datasets. Particular emphasis is placed on projects involving high-throughput technologies capable of generating large volumes of data, especially when applied to the study of cancer and age-related diseases.

The group operates a state-of-the-art Next Generation Sequencing (NGS) platform based on Illumina (NextSeq 2000) and Oxford Nanopore (P24) technologies, enabling the execution of multi-omics analyses, including genomics, metagenomics, epigenomics, and transcriptomics.

These experimental infrastructures are complemented by advanced expertise in bioinformatics and computational analysis, allowing for comprehensive and in-depth characterization of the generated data.
Many of the projects addressed by the group involve complex experimental designs for which standard analysis protocols are not suitable. In such cases, the group develops tailored solutions by leveraging expertise in programming, modeling, and big data management to enable robust data analysis and integration.

The primary research focus is the study of complex biological systems through a multidimensional approach that integrates multiple sources of information, including genomic data, RNA profiles (mRNA, microRNA, long non-coding RNA), and clinical information.
During 2025, the group further expanded its expertise in single-cell analyses, acquiring the necessary instrumentation for single-cell library preparation and developing dedicated bioinformatics pipelines for high-resolution genomic and transcriptomic analyses. These capabilities were strengthened through participation in the D34Health initiative, within which the group contributes to the development of experimental and computational protocols for the characterization of organoids and three-dimensional cultures. Finally, through its involvement in the National Center for RNA-based Drugs, the group is actively engaged in projects focused on the development of antisense oligonucleotides (ASOs) aimed at modulating alternative splicing processes, with potential therapeutic applications. A specific focus of the group is the study of aging and cellular senescence, with the aim of elucidating and modulate the molecular mechanisms underlying age-associated functional decline and disease.



IMAGING AND RADIOMICS

FOCUS

- **Artificial Intelligence and Radiomics in Precision Medicine**
- **Radiomics for the quantitative evaluation of Treatment Efficacy and Prediction**
- ***In Vitro* and *In Vivo* Theranostic studies: New Radiopharmaceuticals for Diagnosis and Therapy**
- **Radiobiology Studies for Dosimetry-Time Effectiveness of Radiopharmaceutical Therapy**

AIMS

- **Develop Artificial Intelligence and Radiomics systems to support Biomedical decision-making**
- **Develop tools for target Detection, Segmentation and Classification in biomedical Imaging**
- **Develop Radiomics tools for Preclinical Biodistribution analysis of Radiopharmaceuticals**
- **Study the effects of ionizing radiation on cellular systems (*in vitro*) and *in vivo* in the context of radiopharmaceutical nanotheranostics**

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Leandra Evola
PhD Student in Molecular and Clinical Medicine- UniPa
Gaspare Centineo
PhD Student in Molecular and Clinical Medicine- UniPa
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PhD Student in Molecular and Clinical Medicine- UniPa

The Imaging and Radiomics Group is a multidisciplinary team united by multimodal imaging research. A synergy of transversal expertise is the basis of this team; in particular, the group is made up of Computer Scientists, Biotechnologists, specialized Medical Doctors and Engineers from different sectors. The focus of the group is twofold. Part of the research concerns the development of Artificial Intelligence (Machine Learning and Deep Learning algorithms) and Radiomics applied to Multispectral and Biomedical Images (Cellular, Preclinical and Clinical) to support Biomedical decision-making. Additionally, this research group utilizes new innovative and translational approaches to support Nuclear Medicine and Precision Medicine through *in vitro*, *ex vivo*, and *in vivo* studies in the fields of radiopharmaceutical therapy, nanoparticles, and biodiversity.

In 2025, the Imaging and Radiomics Group he Imaging and Radiomics Group completed the project for which it was awarded funding in 2024 by THE - Tuscany Health Ecosystem (Innovation Ecosystem - cascade call - National Recovery and Resilience Plan (NRRP) Ministry of University and Research, entitled "study and evaluation of the RADiobiological effect of innovative polymeric nanoparticles of natural origin radiolabeled with radioIsotopO Lu-177 in prostate cancer cell lines" – RADIATIONS. In addition, the Imaging and Radiomics Group maintained and strengthened the GIT and NIH collaboration in the radiomics analysis of magnetic resonance angiography of mice affected by a particular type of anemia, presenting the preliminary results at the ICIAP 2025 23rd International Conference on Image Analysis and Processing, in Rome 15-19 September 2025. As part of their collaboration with the Institute of Bioimaging and Complex Biological Systems (IBSBC-CNR, Milan), the group is conducting preclinical PET and MRI studies to detect early degeneration of neuronal in Parkinson's disease.

In addition, the group has conducted the following research areas in the field of preclinical and clinical molecular imaging with positron emission tomography (PET) in the field of biodiversity, gene therapy in inflammation and cancer:

- A Robust [18F]-PSMA-1007 Radiomics Ensemble Model for Prostate Cancer Risk Stratification;
- An Update on DOTA-Peptides PET Imaging and Potential Advancements of Radioligand Therapy in Intracranial Meningiomas;
- Preliminary Study Exploring the Potential of ML Models Applied to Radiomic Features Extracted from PSMA-PET: Prediction of the PRIMARY and E-PSMA Scores in the Evaluation of Primary PCa Lesions;

Clinical research activities in Imaging and Radiomics included:

- A Generalized Gray Level Co-occurrence Matrix for Rotation-Invariant Texture Detection in Radiomics;
- Features for Active Contour and Surface Segmentation;
- Prostate MRI Segmentation: A Comparative Analysis of U-Net and E-Net Deep Learning Models;
- Prevention and management of degenerative lumbar spine disorders through artificial intelligence-based decision support systems;
- Revolutionizing Periodontal Care: The Role of Artificial Intelligence in Diagnosis, Treatment, and Prognosis;

Several research studies were conducted by the group in the field of:

- Applications of Artificial Intelligence, Deep Learning, and Machine Learning to Support the Analysis of Microscopic Images of Cells and Tissues;
- Radiomic Analysis of Mouse Magnetic Resonance Images and Correlation of Features Extracted to Vascular Defects in Sickle Cell Disease: Preclinical Applications;
- Radiomic Analysis of MR and PET Images of Mice to Identify Possible Microstructural Changes Associated with Early Molecular Changes During Nigral Neuron Deafferentation;

Additionally, the group was involved in the development of:

- Engineered collagen-coated scaffolds for tendon regeneration: a multifunctional drug delivery approach.

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- Pharmaceutical Factory, La Maddalena S.P.A., Palermo, IT
- Department of Biomedicine, Neuroscience and Advanced Diagnostics, (BIND)University of Palermo, Palermo, IT
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- University of Catania, Catania, IT
- Ospedale Generale Regionale "F.Miulli", Bari, IT
- Nuclear Medicine, University of Messina, Messina, IT
- Biomedical Campus University of Rome, Rome, IT
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- La Maddalena Hospital, Palermo, IT
- Department of Engineering, University of Palermo, Palermo, IT
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- The Mediterranean Institute for Transplantation and Advanced Specialized Therapies (ISMETT-IRCCS), Palermo, IT
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- Institute of Bioimaging and Complex Biological Systems (IBSBC) CNR (Palermo and Milan), IT

REGENERATIVE MEDICINE AND IMMUNOTHERAPY

EXPERIMENTAL IMMUNOTHERAPY
HEPATOBILIARY REGENERATIVE MEDICINE
REGENERATIVE MEDICINE AND RNA THERAPIES
GMP CELL FACTORY
PRECLINICAL *IN VIVO* RESEARCH

RI.MED RESEARCH

Two-dimensional co culture of biliary and mesenchymal stromal cells. Blue: nuclei, Green: Cystic Fibrosis Transmembrane conductance Regulator (CFTR), Red: Epithelial Cadherin (ECAD).

Courtesy of the Hepatobiliary Regenerative Medicine Group

PUBLICATIONS

Immune-Based Biomarkers as Predictors of Mortality in ECMO Therapy for Severe COVID-19 ARDS: Insights from a Retrospective Study
Busà R*,†, Panarello G*, Gallo A, Miceli V, Castelbuono S, Sorrentino MC, Amico G, Carcione C, Russelli G, Cuscino N, Miele M, Timoneri F, Di Bella M, Zito G, Barbera F, Badami E, Corsale AM, Shekarkar Azgomi M, Conaldi PG, Botta C, Bulati M†
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Glypican-3-Specific CAR NK Cells Co-Secreting IL-15 and IFN-α Have Increased Anti-Tumor Function Versus Hepatocellular Carcinoma *In Vitro*
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Engineering a Human-Sized Common Bile Duct Prototype with Regenerative Potential: *In Vitro* Evaluation of Mechanics, Function, Degradation, and Immune Modulation
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GMP-compliant, serum-free cultures preserve therapeutic potential of extracellular vesicles from human mesenchymal stromal cells
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Eco-Friendly Fabrication of Secretome-Loaded, Glutathione-Extended Waterborne Polyurethane Nanofibers
Accardo P, Cancilla F, Martorana A, Calascibetta F, Amico G, Pitarresi G, Fiorica C, Chinnici CM, Palumbo FS†
Int J Mol Sci. 2025 Nov 28;26(23):11556
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Immune profiling in solid organ transplant recipients with HHV-8 infection: Identification of immunological biomarkers for KICS and Kaposi's sarcoma
R Busà*, F Timoneri*, M Miele, M Di Bella, A Cona, S Castelbuono, M Ligotti, A Gallo, F Pecoraro, G Randazzo, C Amato, C Pipia, G Amico, V Agnese, PG Conaldi, M Luppi, A Mularoni, M Bulati†
Clinical Immunology. 2025 Nov: 280:110562
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Characterization and Proteomic Profiling of Hepatocyte-like Cells Derived from Human Wharton's Jelly Mesenchymal Stromal Cells: *De Novo* Expression of Liver-Specific Enzymes
Lo Iacono M*,†, Corrao S*, Alberti G, Amico G, Timoneri F, Russo E, Cucina A, Indelicato S, Rappa F, Corsello T, Saieva S, Di Stefano A, Di Gaudio F, Conaldi PG, La Rocca G†
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Wharton's jelly mesenchymal stromal cells derived from preterm umbilical cord reveal a hepatogenic potential
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Transcriptomic profiles of monocyte-derived macrophages exposed to SARS-CoV-2 VOCs reveal immune-evasion escape driven by delta
Gallo A†, Sammartino JC, Vazzana R, Giambruno R, Carcione C, Cuscino N, Castelbuono S, Miceli V, Bulati M, Lilleri D, Cassaniti I, Conaldi PG, Baldanti F
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J Transl Med. 2025 Mar 14;23(1):332
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Differentially expressed microRNAs in pre-transplant lung biopsies target immune checkpoint proteins and can predict primary graft dysfunction in lung transplantation
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Circulating biomarkers in patients with progressive fibrosing interstitial lung disease treated with nintedanib: a pilot study
Miceli V†, Callari A, Calzolari E, Castelbuono S, Carcione C, Lanzarone N, Martino L, Conaldi PG, Pinzani M, Vitulo P†
Sci Rep. 2025 Jul 25;15(1):27115
doi: 10.1038/s41598-025-12952-1

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EXPERIMENTAL IMMUNOTHERAPY

FOCUS

- **Engineering of CAR-NK cells for the treatment of liver cancer**
- **Increasing the anti-tumoral function of NK cells by *ex vivo* activation with specific cytokines**
- **Understanding the role of dendritic cells in tolerance induction**
- **Development of GMP-compliant protocols for large scale cell production for clinical applications**
- **Production of Tolerogenic Dendritic Cells**

AIMS

- **Treatment of patients affected by liver cancer with innovative CAR-NK cells engineered to have enhanced specificity to hepatocellular carcinoma**
- **Early weaning off immunosuppressive therapy of Solid Organ Recipient using Tolerogenic Dendritic Cells**
- **Development of "off-the-shelf" cellular products**

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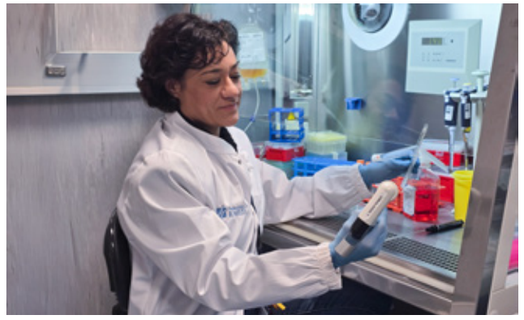
- Thomas E. Starzl Transplantation Institute, University of Pittsburgh School of Medicine, Pittsburgh, US
- Experimental Zooprophylactic Institutes of Sicily (IZS Sicily), IT
- National Research Council (CNR), IT



Our research program is dedicated to the development of advanced cell-based therapeutic platforms aimed at extending survival and improving long-term outcomes in patients undergoing solid organ transplantation and in those affected by malignancies. During 2025, our efforts were primarily directed toward the advancement of innovative immunotherapeutic strategies for hepatocellular carcinoma (HCC), with a particular emphasis on cell-mediated approaches. In parallel, a complementary line of investigation in our laboratory addresses the role of tolerogenic dendritic cells (DCs) in the induction and maintenance of operational immune tolerance in solid organ transplant recipients.

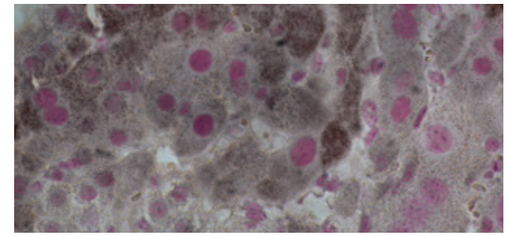
HCC is a primary malignant epithelial neoplasm arising from hepatocytes and represents a leading cause of cancer-related mortality worldwide. Although curative-intent remain the standard of care, recurrence rates remain unacceptably high. These limitations underscore the urgent need for novel therapeutic strategies.

Natural killer (NK) cells are pivotal effectors of the innate immune response against virally infected and transformed cells. Both the frequency and functional competence of NK cells have been correlated with recurrence risk and overall survival in patients with resectable HCC. Liver-resident and liver-derived NK cells are therefore considered critical mediators of intrahepatic immune surveillance.

We have patented a proprietary methodology enabling the isolation of high yields of viable NK cells from an alternative source—namely, the liquid perfusate of livers obtained from deceased donors. In addition, we have optimized *ex vivo* expansion protocols capable of generating clinically relevant cell numbers suitable for therapeutic application. Importantly, we have demonstrated that cytokine preconditioning of NK cells with interferon-α (IFN-α) significantly enhances their antiviral and antitumor activity, both *in vitro* and in preclinical *in vivo* models. Having completed the requisite proof-of-concept studies, this cellular product is now poised for clinical translation.

To further augment specificity and cytotoxic efficacy, we have implemented genetic engineering strategies, including chimeric antigen receptor (CAR) technology. We have characterized a novel fourth-generation lentiviral CAR construct targeting Glypican-3 (GPC3) highly expressed in HCC, engineered to promote the secretion of immunostimulatory cytokines—interleukin-15 (IL-15), and IFN-α. For safety control, the vector also encodes a suicide switch.

In close collaboration with ISMETT researchers and the Starzl Transplantation Institute in Pittsburgh, our laboratory is developing a cell-based strategy to induce operational tolerance in liver and kidney transplantation through the administration of donor-derived tolerogenic dendritic cells. Chronic graft rejection remains a major challenge in transplantation medicine, necessitating lifelong immunosuppression. The adoptive transfer of tolerogenic DCs represents a promising approach to facilitate early immunosuppression weaning and promote durable graft acceptance. In this context, we are exploiting liver perfusate from deceased donors as a novel and readily accessible source of DC precursors, thereby integrating our expertise in organ-derived cellular products with translational immunotherapy strategies.



Histological section of the liver. The hepatocyte nucleus is stained magenta following immunohistochemical staining with PAS (Periodic Acid-Schiff Reagent).

HEPATOBILIARY REGENERATIVE MEDICINE

FOCUS

- **Engineering artificial bile ducts**
- **Developing advanced biliary organoid models**

AIMS

- **Enhance vascularization in bioartificial bile ducts to improve host integration**
- **Assess the safety and efficacy of artificial bile ducts *in vivo***
- **Optimize biliary cell culture, including 3D organoids, to provide robust, reproducible, and functional platforms for multiple applications**

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The Hepatobiliary Regenerative Medicine group focuses on developing strategies for biliary diseases, guided by two central questions: whether failing bile ducts can be replaced with bioengineered tissue or supported using organoids derived from biliary epithelial cells, and whether organoids modeling cholangiocarcinoma can accelerate the development of new therapeutic approaches.

A major achievement of the group is a patent application and a publication in Advanced Healthcare Materials describing an implantable bile duct prototype. The prototype is structured as a multiphasic tubular scaffold featuring three distinct layers: an electrospun PCL core for mechanical stability, an inner layer of biliary epithelial cells embedded in ColMA forming a functional epithelial compartment, and an outer acellular ColMA layer. Key innovations include the first reported combination of PCL and ColMA in a biliary construct, the use of biliary epithelial cells as the cellular component, and a reproducible fabrication workflow supported by multidisciplinary characterization. The construct demonstrated robust mechanical performance, leak-proof functionality, bile acid transport, and a favorable immune profile in *ex vivo* blood assays. Although developed for biliary repair, the materials and fabrication strategy are adaptable to other tubular tissues.

Current work focuses on enhancing the prototype's biological relevance and translational potential. While the initial prototype relied on biliary epithelial cells expanded in two-dimensional culture, the group has transitioned to three-dimensional organoid systems. In the multiphasic tubular scaffold, the two ColMA layers are seeded with defined organoid populations, testing different combinations of biliary epithelial cells and supportive cells, including mesenchymal stromal and endothelial cells. These organoid-populated layers form a structured, physiologically relevant architecture with the potential to enhance epithelial formation and support vascular integration upon implantation. Reproducibility and functional reliability are ensured through biophysical profiling of individual organoids using the W8 Physical Cytometer, measuring size, weight, and mass density to assess intra- and inter-batch variability.

In parallel, within the CASTOR & POLLUX project (Center for Acquisition, STOrage, and Processing of Multi-Omics Data from Three-Dimensional Cellular Models; D3 4 Health Initiative – Digital Driven Diagnostics, Prognostics and Therapeutics for Sustainable Health Care, Spoke 4), molecular profiling of organoids is integrated with biophysical data to identify key regulatory pathways. This approach enables the selection of reproducible and clinically relevant organoid phenotypes and guides their further optimization through refined culture protocols. An ***in vivo*** safety study of the upgraded bile duct substitute incorporating these advanced organoid systems is planned.

Concurrently, the group has established scaffold-free and scaffold-based three-dimensional cultures of intrahepatic cholangiocarcinoma cells and is investigating how stress-response pathways influence tumor proliferation, invasion, and chemoresistance.
By integrating medical device development, advanced organoid technologies, and disease modeling, the group aims to accelerate the translation of innovative therapeutic strategies for biliary disorders.

REGENERATIVE MEDICINE AND RNA THERAPIES

FOCUS

- **Molecular target discovery:** identification of novel genes and signaling pathways involved in the progression of chronic liver diseases
- **RNA therapeutics:** experimental validation of therapeutic microRNAs (miRNAs) and small interfering RNAs (siRNAs) using advanced *in vitro* models of chronic liver disease
- **MSC-derived therapeutics:** production and characterization of mesenchymal stromal cell (MSC)-derived secretome and extracellular vesicles (EVs)
- **Functionalized biomaterials:** development of secretome- and EV-loaded biomaterials designed to enable controlled release, enhanced stability, and improved therapeutic efficacy

AIMS

- **Development of RNA-based therapeutic strategies for metabolic liver diseases.**
- **Optimization of cell-free regenerative therapies based on MSC-derived secretome, extracellular vesicles, and functionalized biomaterials for the treatment of chronic skin wounds**

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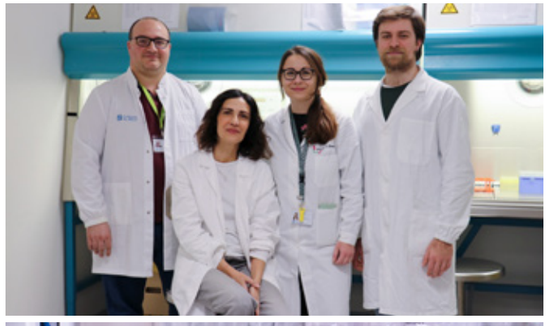

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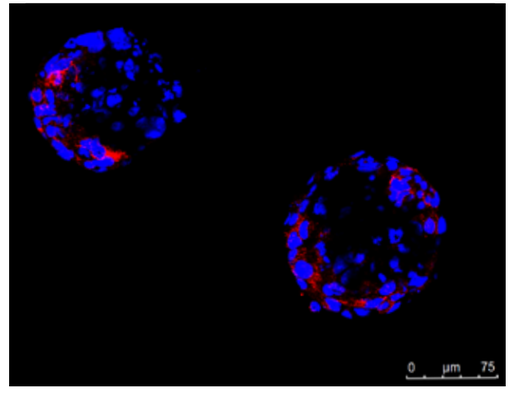
- Lab of Translational Research, Dept of Medical Sciences, University of Turin, Torino, IT
- National Center for Gene Therapy and Drugs based on RNA Technology, University of Padova, Padova, IT

The Regenerative Medicine and RNA Therapies team is dedicated to developing RNA-based therapeutic strategies, including microRNAs (miRNAs) and small interfering RNAs (siRNAs), for the treatment of chronic liver diseases such as metabolic dysfunction-associated steatohepatitis (MASH) and liver fibrosis.

Through comprehensive molecular and functional analyses, the team investigates gene expression changes, signaling pathway modulation, and phenotypic responses following RNA intervention. These studies aim to identify the most promising therapeutic RNA candidates and to generate robust preclinical evidence to support their translational advancement. A central component of this research is the optimization of advanced three-dimensional *in vitro* models of liver steatosis and fibrosis to validate potentially therapeutic miRNAs and siRNAs. These physiologically relevant systems allow precise

assessment of target engagement, multi-pathway regulation, and functional outcomes, strengthening the predictive value of preclinical testing. In this context, the team collaborates with the University of Turin to advance liver-directed RNA therapies. The collaboration includes the production of miRNA-engineered extracellular vesicles designed to enhance liver targeting and intracellular RNA delivery. These engineered EVs are currently under evaluation in mouse models of MASH and fibrosis to assess therapeutic efficacy, biodistribution, and treatment-related toxicity.

Complementing RNA-based interventions, the team also develops regenerative strategies based on cell-derived products, including the secretome and extracellular vesicles from human mesenchymal stromal cells (MSCs). These approaches aim to modulate inflammation, promote tissue repair, and restore organ function through cell-free mechanisms. In collaboration with IRCCS ISMETT and the University of Palermo, secretome-based biomaterials are being evaluated in mouse models of chronic skin wounds to assess their regenerative efficacy and functional outcomes. One biomedical device derived from this technology has been filed for patent protection with the World Intellectual Property Organization (WIPO). Together, these integrated research lines bridge RNA engineering, advanced disease modeling, and secretome-driven regenerative approaches to establish innovative cell-free therapeutic platforms with strong translational potential for chronic liver diseases and tissue repair.



Confocal immunofluorescence image of a 3D liver spheroid model of fibrosis, composed of hepatocytes and human hepatic stellate cells co-cultured and activated with TGF-β1 for 3 days. Cells were stained with an anti-collagen α1 antibody to detect extracellular matrix deposition. Collagen is shown in red, and nuclei are counterstained with DAPI (blue).

GMP CELL FACTORY

FOCUS

- **Cell based therapies for end stage organ failure (e.g. based on MSCs)**
- **Immunotherapies, e.g. Multivirus specific T lymphocytes**

AIMS

- **Contribute to translational medicine, providing new ATMPs to patients**
- **ATMPs release for Phase I studies and single patient use**
- **Optimization/automation of production processes and Quality Control (QC) tests**

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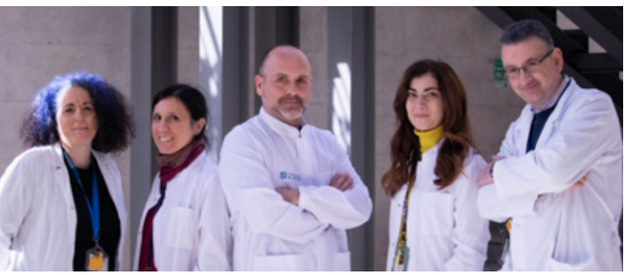

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- ISMETT-IRCCS Ospedale Galeazzi-Sant'Ambrogio, IT
- University of Pittsburgh, Pittsburgh, US

The Cell factory group has developed an Advanced Therapy Medicinal Product (ATMP) consisting in polyclonal multivirus specific T cells (MVT-cells) for autologous and allogeneic applications. The protocol is based on the stimulation of T lymphocytes with a mix of peptides derived from Epstein-Barr virus (EBV), Cytomegalovirus (CMV), BK polyomavirus (BKV) and Adenovirus (ADV). The product, multivirus-specific T cell clones, is capable of containing or treating virus related post-transplant complications (i.e. primary infections or virus reactivation). Other ATMPs are being developed by ISMETT and Ri.MED researchers and are being evaluated for future GMP productions. The Production Group, in collaboration with infectious disease specialists and researchers from ISMETT IRCCS, is also actively involved in a clinical project aimed at monitoring the clinical conditions and outcomes of solid organ transplant recipients following primary infection or reactivation of the HHV-8 virus, as well as identifying potential neoplastic complications. HHV-8 infection can lead to the development of neoplastic diseases, including Kaposi's sarcoma (KSHV), Castleman disease, and primary effusion lymphoma (PEL), as well as non neoplastic conditions such as KICS (KSHV-associated inflammatory cytokine syndrome). Currently, no international guidelines or fully effective therapies are available for these diseases. More in detail, the Production Group focuses on the immunological monitoring of patients by analysing the T-cell specific response through the ELISpot assay for INF-gamma production. T cells are collected from patients and stimulated with HHV-8 latent and lytic phase antigens (K8, K12, LANA, GB). The purpose of this analysis is to integrate clinical evidence into patient follow-up.

In 2024, this research activity led to the publication of an article in the American Journal of Transplantation, which was described by reviewers as an excellent contribution to the global medical literature. The journal editors commented on the study stating that "the study represents a step forward in our understanding of a rare but potentially fatal event: donor-derived KSHV-related disease, manifesting as KICS". Moreover, in collaboration with the ISMETT Paediatric Unit, the Production Group currently supports diagnostic investigations into the immune response to viral infections in paediatric patients. In this context, INF-gamma production is assessed using the ELISpot assay, following stimulation with Cytomegalovirus (CMV) and Epstein-Barr Virus (EBV) antigens.

PRECLINICAL *IN VIVO* RESEARCH

FOCUS

- **Test surgical, pharmacological, metabolic, gene and immunological therapies on animal models that mimic terminal organ failure**
- **Safety ed efficacy of scaffold**
- ***In vivo* Proof-of-concept**
- **Training for MD and DVM**

AIMS

- **Welfare of Laboratory animals**
- **Drafting of the protocol**
- **Standardization of animal model**
- **3R Application (Reduction, Replacement and Refinement)**
- **Training modules for researchers and personnel who perform procedures (function A), take care of animals (function C), euthanize animals (functionD) and design procedures and projects (function B)**

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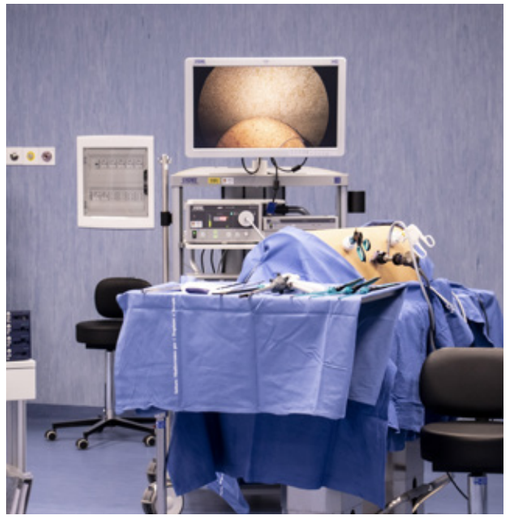
- Experimental Zooprophylactic Institutes of Sicily (IZS Sicily) Palermo, IT
- Experimental Zootechnical Institute for Sicily (ISZS) Palermo, IT

Our research is focused on the development of animal pathological models, the improvement of housing conditions based on species' needs and their microbiological condition and experimental refinement procedures, in order to improve animal wellbeing, and to standardize protocols to obtain robust data. To date, as the Ri.MED Foundation does not have its own animal facility, the preclinical *in vivo* group uses animal facilities of our institutional partners (such as IZS Sicilia and ISZ) and acts as an interface between Ri.MED research groups and Competent Authorities to carry out the *in vivo* projects and to obtain the mandatory authorization.

In the course of 2025 we have concentrated our activities giving support to the researchers, supporting them for the drafting of the necessary documents for the Ministerial authorizations and the experimental protocols *in vivo*, by dealing with the application of 3R (refinement replacement and reduction) and obtaining the necessary authorisations for the import, removal and use of organs and tissues for *ex vivo* testing.

The Fondazione Ri.MED *in vivo* preclinical area provided technical and regulatory support for obtaining the Ministry of Health authorization, pursuant to Article 20 of Legislative Decree 26/2014, for the ISPEMI user establishment for pigs and sheep. Moreover, our group has been included in educational projects in local schools, with the aim of offering the means to understand the need for preclinical research *in vivo*, the progress that research has achieved thanks to the conscious use of the animal, assessing them by criticizing them or supporting them, with a critical spirit free from prejudices. Furthermore, our group takes care of training external and internal personnel for functions a) b) c) d) of the directorial decree on training pursuant to art. 23 Legislative Decree 26/14.



BIOENGINEERING AND TISSUE ENGINEERING

BIOENGINEERING AND MEDICAL DEVICES
CARDIOVASCULAR TISSUE ENGINEERING
MUSCULOSKELETAL TISSUE ENGINEERING

Multiphoton image stack of an embryo during the aggregation phase, using the killifish Fundulus heteroclitus as a model system to investigate embryonic development and vestibular adaptation in orbital flight. The study was conducted in collaboration with the Trivedi Institute (Prof. Jason Podrabsky and Prof. Beheshti Afshin) and Prof. Antonio D'Amore.

Courtesy of Federica Cosentino, PhD - Cardiovascular Tissue Engineering Group

PUBLICATIONS

Inversion of the thermomechanical response in nitinol under cyclic loading: an analytical interpretation based on the thermoelastic effect theory
Pinto V*, Di Leonardo S*, Pitarresi G†, Burriesci G
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Hunter L†, Torii R, Burriesci G, Bertazzo S†
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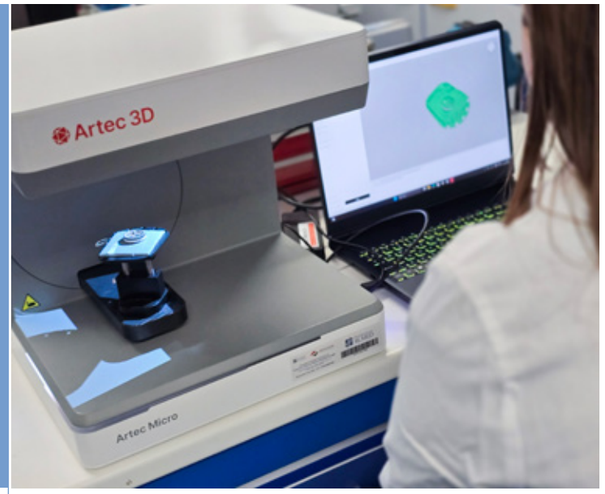

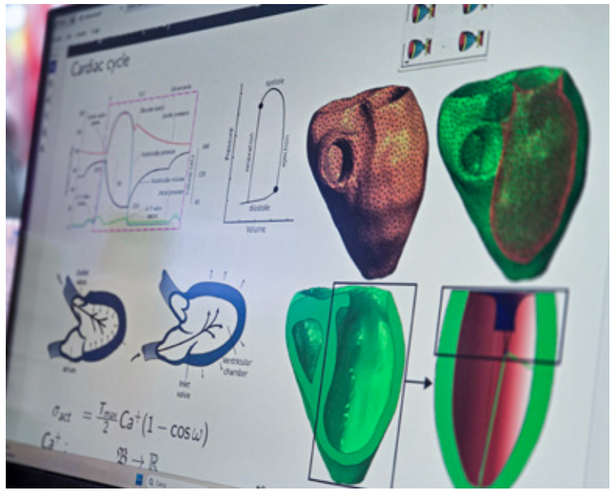

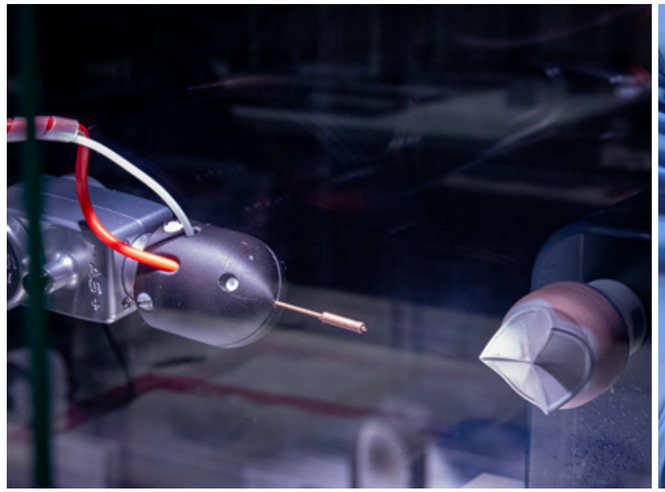

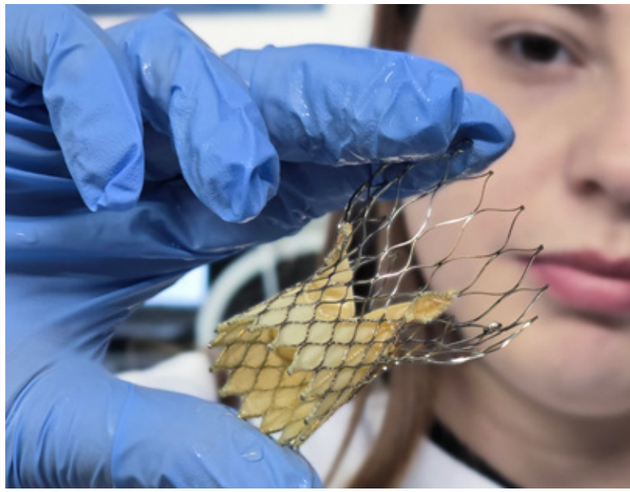

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Author Correction: Valvulogenesis of a living, innervated pulmonary root induced by an acellular scaffold
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doi: 10.7150/ijbs.113920

Photo-oxidation Cross-Linked, Glutaraldehyde Cross-Linked, or Enzyme and Hydrostatic Pressure Processed Decellularized Biomaterials for Cardiovascular Repair Do Not Affect Host Response in a Rat Right Ventricular Outflow Flow Tract Reconstruction (RVOT) Model
Boodagh P, De Mohac LM, Hayashi Y, Vella D, Ye SH, Cosentino F, Fujii T, Gorge E, Coyan G, Soto JDL, Burriesci G, Wagner WR, D'Amore A†
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ERJ Open Research 2025 11(suppl 15): TP323
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Tissue engineering for tendon and ligament repair: Insights and advances
Romano F, Lopresti F, Di Gesù R†, La Carrubba V
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Tunable smart biomaterial for cartilage regeneration (ultracart regenera)
Di Gesù R†, Burriesci G, Lopresti F, Romano F, Di Leonardo S, La Carrubba V
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Innovative electrospun scaffolds for tendon regeneration: a novel approach to prevent post-surgical fibrosis
Romano F†, Lopresti F, Di Marco C, La Carrubba V, Di Gesù R
Orthop Procs. 2025;107-B(SUPP_6):100-100
doi: 10.1302/1358-992X.2025.6.100

Biofabrication of an *in situ* hypoxia-delivery scaffold for cartilage regeneration
Di Gesù R†, Palumbo Piccionello A, Vitale G, Buscemi S, Panzavolta S, Di Filippo MF, Leonarda A, Cuccia M, Di Prima A, Gottardi R
2025 Biofabrication 17 025025
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Engineered collagen-coated scaffolds for tendon regeneration: a multifunctional drug delivery approach
Di Marco C*, Romano F*, Lopresti F, Campora S, Comelli A, Di Gesù R†, La Carrubba V,
International Journal of Biological Macromolecules, 315, 2, 2025
doi: 10.1016/j.ijbiomac.2025.144445

* These authors contributed equally to this work.
† To whom correspondence should be addressed.

BIOENGINEERING AND MEDICAL DEVICES

FOCUS

The Bioengineering & Medical Device group is dedicated to the development and translation of innovative therapeutic treatments, including:

- **Next-generation medical devices**
- **Advanced diagnostic solutions**
- **Therapeutic planning tools**

AIMS

The group strives to:

- **Support local healthcare institutes through cutting-edge engineering solutions**
- **Provide engineering expertise to enhance clinical decision-making**
- **Facilitate the development of breakthrough therapies and diagnostic technologies**
- **Advance therapeutic treatments to improve patient outcomes**

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Valentina Pinto, BEng MSc
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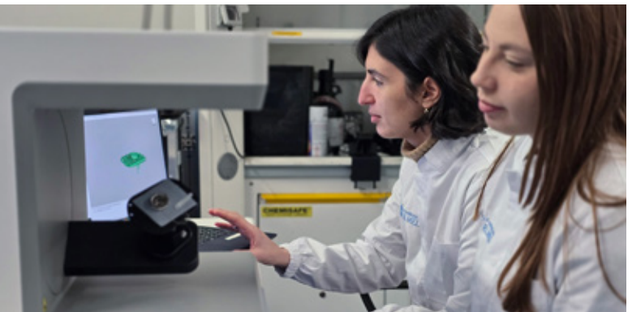
COLLABORATIONS

For details see page 90 (Partnership and Collaborations)

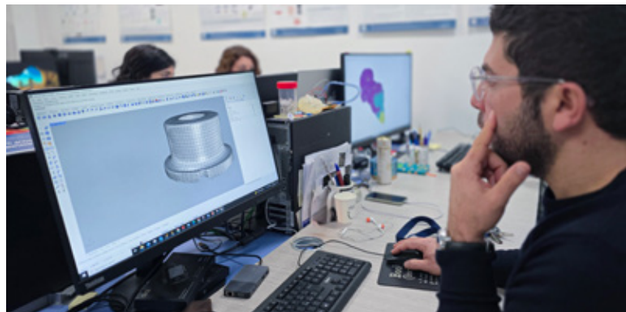


The Bioengineering & Medical Devices group applies engineering principles and physical science to analyse biological systems and develop next-generation biomedical technologies. Operating primarily in the cardiovascular field, it contributes to the conception and optimisation of advanced diagnostic solutions, support tools for therapeutic planning and new-generation medical devices. Its research team offers solid skills in numerical modelling, fluid-structural analysis, and medical device design and development.

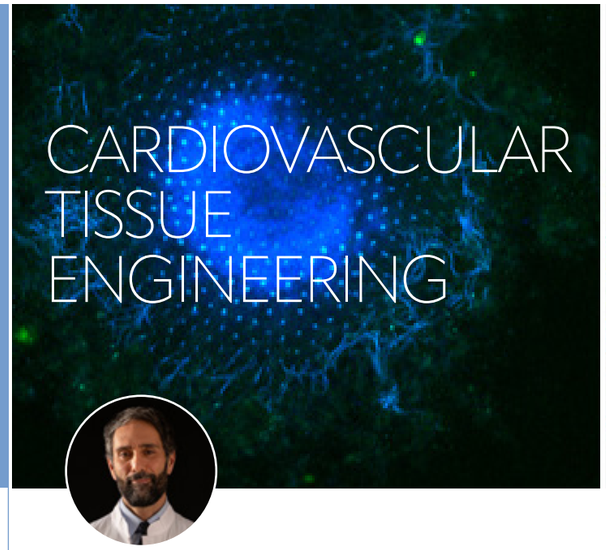
The group has substantially contributed to expanding the medical technology portfolio at Ri.MED, by introducing novel surgical and minimally invasive cardiovascular repair and replacement solutions. In 2025, it supported the industrial partners in the industrialisation of the SIKELIA™ transcatheter aortic valve system. The development of the device IP, owned by Ri.MED, was led by Gaetano Burriesci, coordinator of the Group. In 2021, the technology was licensed to MitrAssist, a multinational cardiovascular company, and in 2022 became the first polymeric transcatheter valve ever implanted in humans. At present, the device has completed a two-year follow-up in 12 patients from four centres. Based on this success in 2025 the SIKELIA™ has been included in a clinical trial registry from NMPA in China. In addition to these clinical milestones, the group published 14 new scientific articles in leading journals, participated in 10 scientific conferences, and delivered 3 invited talks at international events, covering both fundamental and applied cardiovascular engineering. Key breakthroughs include the refinement of in-house computational tools to simulate complex haemodynamics and thrombus formation in the left atrial appendage (LAA), predicting growth and embolization risks in ischaemic events.

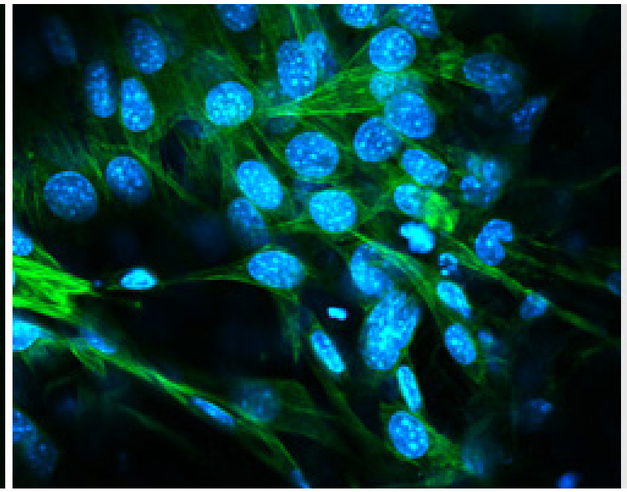
Together with the Ri.MED Tissue Engineering group, it characterised and compared new patches for cardiovascular and heart valve applications. In partnership with the University of Palermo, the team also identified superior suture techniques for meniscal tears, utilised infrared thermography to study the thermomechanical behavior of austenitic nitinol used in stents, and characterised chitosan-based hydrogels with nanometric hydroxyapatite fillers, demonstrating improved mechanical strength and stability for bone tissue engineering. In collaboration with UCL, they implemented new analytical tools to predict crystal size and surface evolution during crystallisation and identified the crucial role of Whitlockite nanoparticles in supporting poorly crystalline apatite formation, suggesting explanations for their co-localisation in human diseases. By comparing the fluid dynamics of surgical and transcatheter valve replacements, the group has improved the understanding of hemodynamic alterations for future device optimization. Furthermore, they developed more realistic structural models for LAA occluding devices and a novel synchronised balloon aortic valvuloplasty approach, designed to eliminate rapid ventricular pacing during heart valve implantation.

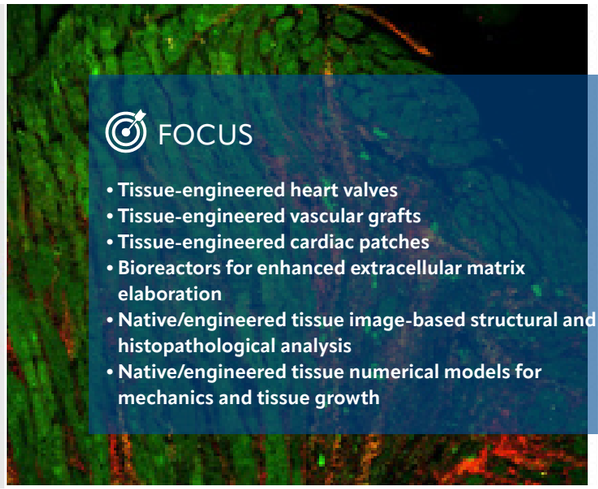
In 2025, the group successfully completed Project PRISMA, funded in 2024, allowing to establish new collaborations with biomedical companies in the territory and attract further funding for translation into clinic. These have led to the Project STRIKE, which will be led by Dr Danila Vella, and aims to develop a telemedicine platform integrating machine learning and synthetic LAA models to enhance personalised risk stratification and precision medicine.
Altogether, to date the described results strengthen the group's international reputation consolidating its reference role for regional healthcare, for the local academic institutions, and for the small and medium enterprises in the geographic area.



CARDIOVASCULAR TISSUE ENGINEERING







FOCUS

- Tissue-engineered heart valves
- Tissue-engineered vascular grafts
- Tissue-engineered cardiac patches
- Bioreactors for enhanced extracellular matrix elaboration
- Native/engineered tissue image-based structural and histopathological analysis
- Native/engineered tissue numerical models for mechanics and tissue growth

AIMS

- development of engineered heart valves
- development of engineered vascular grafts
- development of engineered cardiac patches
- quantitative histology and biomaterials micro-structure image-based analysis
- structural modeling strategies to predict tissue growth and scaffold degradation
- mechanical and topological conditioning for tissue elaboration

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Alfonso Emmanuel Castaneda Serrano, MS
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Matthias Jacquot
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Marco Ricchiari
MSc Student, University of Padova

The D'Amore's Cardiovascular Tissue Engineering group aims to integrate a mechanistic understanding of scaffold–host interaction with the development of novel biomaterials and tissue engineering strategies. The focus of our research is upon unmet clinical needs in cardiovascular diseases. Research interests include six highly interconnected areas: I) quantitative histology and biomaterials micro-structure image-based analysis, II) structural modeling strategies to guide tissue engineering scaffold fabrication, III) mechanical and topological conditioning for tissue elaboration, IV) development of cardiac restraint devices, V) vascular grafts and VI) engineered heart valves.

Our multidisciplinary research team, currently 20+ people strong, includes biomedical, mechanical, and structural engineers as well as biotechnologists, biologists, clinicians in addition to a number of interns and Master of Science's degree students.

The Ri.MED laboratory, established in 2020 and graciously hosted by the Departments of Chimica e Fisica, and STEBICEF, University of Palermo (UNIPA), includes >100 m^2 of fully equipped, independent lab space and 300 m^2 of office and numerical lab space located in buildings 16 and 18 of the UNIPA campus. Two major technology platforms have been developed since 2020 and cover biomaterials processing, characterization, biological imaging and histology. The group operates also in a second location within the McGowan Institute for Regenerative Medicine, Departments of Surgery and Bioengineering, University of Pittsburgh and includes additional 70 m^2 of fully equipped wet lab space, and office space.

COLLABORATIONS

- University of Palermo, Palermo, IT
- Advanced Technologies Network Center (ATeN Center), Palermo, IT
- McGowan Institute for Regenerative Medicine (MIRM), Pittsburgh, US
- University of Pittsburgh Medical Center (UPMC), Pittsburgh, US
- The Mediterranean Institute for Transplantation and Advanced Specialized Therapies (ISMETT-IRCCS), Palermo, IT
- Universidad Abierta Interamericana (UAI), Buenos Aires, AR
- Neoolife, Pittsburgh, US
- TELEA BioTech, Sandrigo, IT
- Columbia University Irving Medical Center (CUIMC), New York, US
- Technical University of Munich, (TUM), Munich, DE
- University of California Irvine (UCI), Irvine, US
- Eindhoven University of Technology, Netherland, NL
- Politecnico di Torino, IT
- Università di Cagliari, IT
- Policlinico di Milano, IT
- Campus Biomedico, Roma, IT
- Università Cattolica del Sacro Cuore, Roma, IT

MUSCULOSKELETAL TISSUE ENGINEERING

FOCUS

- **Cartilage and bone pro-regenerative technologies**
- **Bioactive materials stimuli-responsive**
- **Tendon/ligament-like scaffolds**
- ***Ex vivo* tissue culturing**
- **Reliable musculoskeletal diseases modeling**

AIMS

- **Biofabrication of active scaffolds for the cartilage focal lesions repair**
- **Production of engineered tendon-like constructs supporting the surgical tendon/ligament reconstruction**
- **Set-up of advanced *in vitro* models of musculoskeletal diseases**
- **Use of macrofluidic bioreactor for the *ex vivo* culturing of biphasic tissues**

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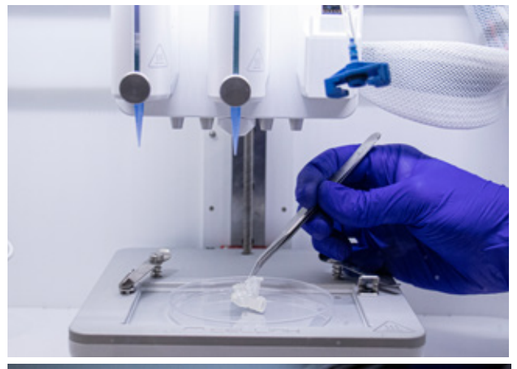
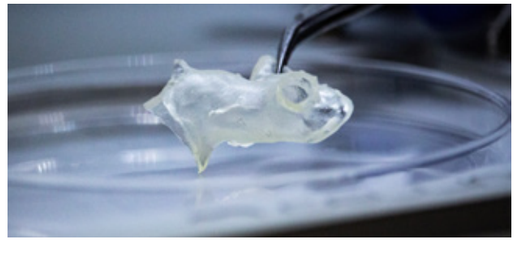
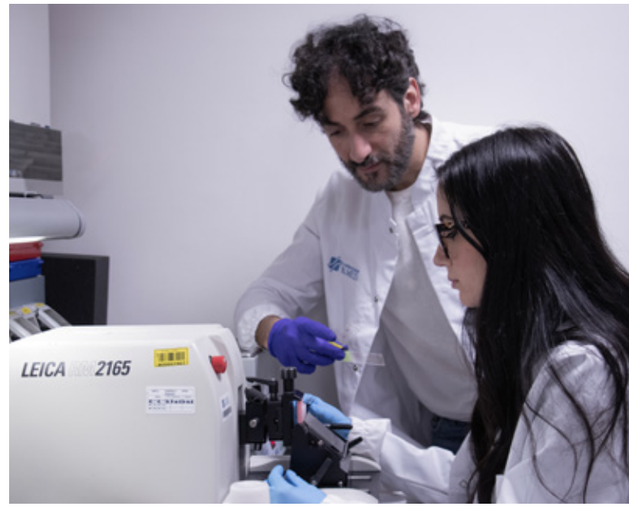




The MusculoSkeletal Tissue Engineering (MSTE) group is dedicated to pursuing as a main objective the advancement of groundbreaking strategies for the treatment of various pathologies that affect ligaments, tendons, cartilage, bone, and muscles. In order to achieve this goal, the MSTE group employs a wide range of innovative approaches relying on tissue engineering technologies. These approaches are based on the most advanced techniques of biofabrication, including but not limited to 3D printing, electric-field induced biofabrication, and bioprinting. Notably, the MSTE research is developed jointly with the Bioengineering and Biomaterials Laboratory at the Children's Hospital of Philadelphia (CHOP, PA - USA) led by prof. Riccardo Gottardi. The primary focus of the MSTE group is to fabricate bioactive scaffolds able to provide pro-regenerative cues for cells that are either seeded onto or embedded within these kinds of 3D supports. Following this approach, we aim to support reconstructive surgery after tendons/ligaments injuries promoting the regeneration of functional tissue in the mid-term. Analogously, our activity aims to restore the functionality of joints affected by focal chondral defects developing functional scaffolds stimuli-responsive, with a vision toward a clinical translation in the near future. In addition, the MSTE group is leading several projects aimed to the development of highly realistic *ex vivo* models of pathologies affecting the musculoskeletal system. Such an activity is supported by the employment of a proprietary technology based on macro-fluidic bioreactors for the culturing of biphasic tissues in native-like conditions. The MSTE group is actively involved in numerous collaborations with international partners, which allow the design and management of different interdisciplinary projects. These collaborations serve as a fertile ground for the exchange of knowledge, expertise, and resources, enabling the MSTE group to push forward the boundaries of innovation. In this direction, we are developing engineered models of muscle tissue with a specific focus on fill the gap in the knowledge of the intricate interplay between the pathologies affecting the nervous system and the musculoskeletal apparatus. This groundbreaking research provides a deeper insight into the mechanisms underlying various neuromuscular disorders and facilitates the exploration of innovative therapeutic approaches.



COLLABORATIONS

- AO Research Institute Davos (ARI), Davos, CH
- Faculty of Medicine & Dentistry, Queen Mary University of London, Malta Campus, Malta, MT
- The Mediterranean Institute for Transplantation and Advanced Specialized Therapies (ISMETT), IT
- University of Pittsburgh Medical Center (UPMC), US
- University of Bologna (Alma Mater Studiorum), IT
- Buccheri la Ferla clinic, IT
- University of Palermo, IT
- The Children Hospital of Philadelphia (CHOP), US
- MERLN Institute for Technology-Inspired Regenerative Medicine, NL

TECHNOLOGY PLATFORMS

BIOENGINEERING
BIOINFORMATICS
CELL FACTORY
BIOMEDICAL IMAGING AND RADIOMICS
MEDICINAL CHEMISTRY
MOLECULAR INFORMATICS
PROTEOMICS
SCREENING
STRUCTURAL BIOLOGY AND BIOPHYSICS
TISSUE ENGINEERING

With a strong translational orientation, Ri.MED's strategy prioritizes the continuous development of advanced expertise and technological platforms, positioning itself as a key driver of innovation and a magnet for global scientific talent. In recent years, these capabilities have been significantly strengthened, also through funding from the Sicilian Region and the Dipartimento "Casa Italia" of the Presidency of the Council of Ministers.

The **Structural Biology and Biophysics Platform** provides an integrated suite of state-of-the-art technologies for high-resolution characterization of biomolecular structure, dynamics, and interactions. In 2025, the platform was further equipped with two new devices for the precise quantification of biomolecular interactions, stability, and aggregation behavior across a wide range of conditions.

A complete pipeline for compound management is in place at the **Molecular Informatics platform**: from an automated system for the liquid handling of compounds to the storage and management of molecular libraries.

The **Medicinal Chemistry Platform** has further equipped the laboratories to support its organic synthesis activities, ranging from reactions set-up to isolation, analytical structure characterization, and purity grade assessment of title compounds.

In 2025 the **Screening Platform** gained new optics to provide higher resolution imaging in high-content image (HCI) applications.

The **Bioinformatics Platform**, in addition to providing expertise in computational biology applications, has recently set up an advanced molecular biology and genome sequencing experimental platform for Next Generation Sequencing (NGS) and single cell genomics, epigenomics and transcriptomics data generation and analysis.

In parallel, two state-of-the-art mass spectrometers, together with dedicated facilities for tissue culture, biochemistry and orthogonal validation of proteomic data, enable the **Proteomics Platform** to carry out fully integrated workflows: from experimental design, biological sample collection and processing, high-resolution LC-MS/MS acquisition, advanced bioinformatic analysis and rigorous downstream validation to ensure the robustness, reproducibility and biological relevance of the findings.

The **Biomedical Imaging and Radiomics Platform** has enhanced its in vitro and in vivo imaging capability with a micro-computed tomography, an optical imaging system for in vitro and in vivo applications, and a gamma counter and radioprotection devices for in vitro, in vivo and ex vivo Radiobiology studies on innovative radiopharmaceuticals.

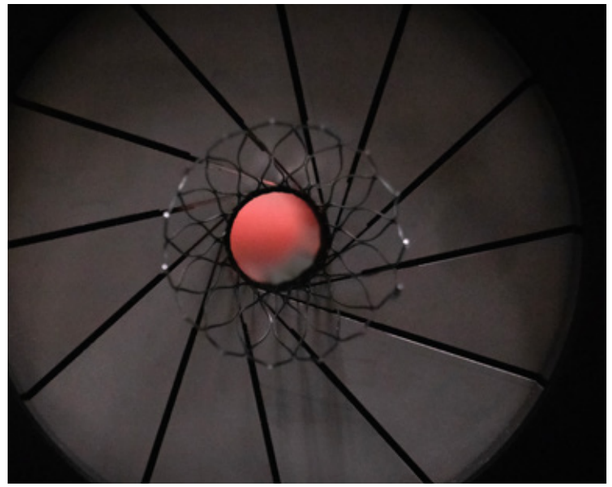
The **Bioengineering Platform** was equipped with two 3D printers and a set of two 3D scanners for production and high accuracy quality inspections of in-house built prototypes, in addition to an ultrasound system with probes. These technological upgrades enable functional and mechanical characterization of biomaterials and medical devices, together with comprehensive performance assessment and preclinical evaluation.

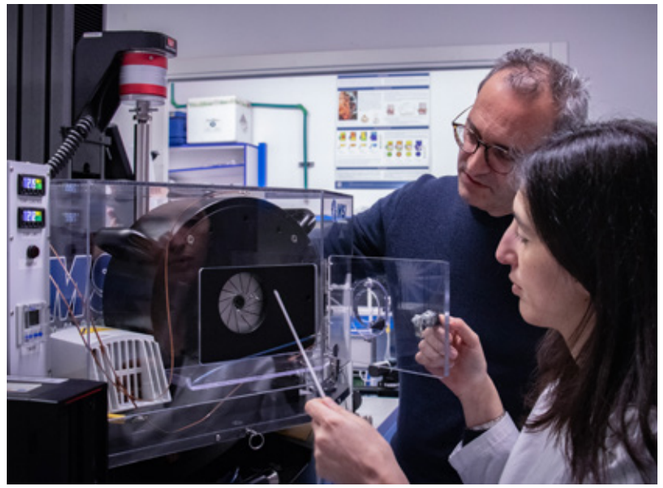
To date the **Tissue Engineering Platform** is equipped with full spectrum 3D printing suite that integrates polymeric, gel, cell-seeded, metallic and plastic materials. Imaging capacities have been significantly expanded through the introduction of dedicated biological imaging unit that includes histological, immunohistochemical preparation stations and advanced multiphoton microscopy.

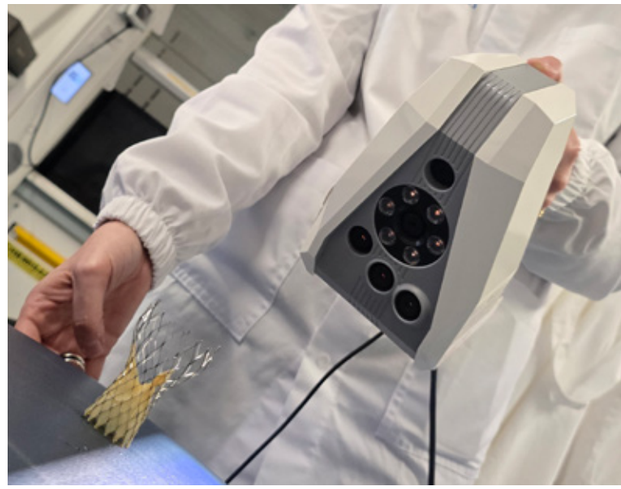
The **GMP Cell Factory** is fully equipped for the production and quality control of Advanced Therapy Medicinal Products (ATMPs) and will become operative in the near future.

Ri.MED's technological platforms propose themselves to serve for a dual purpose: they provide essential support for internal research projects, ensuring access to advanced instrumentation and expertise, and they also offer specialized services to external partners. This dual role aims at fostering new scientific collaborations, facilitates knowledge exchange, and enables the translation of innovative technologies across both academic and industrial settings.

Bioengineering
PLATFORM







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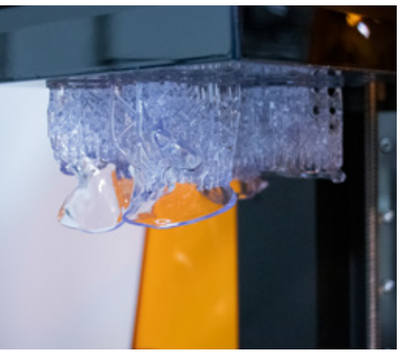
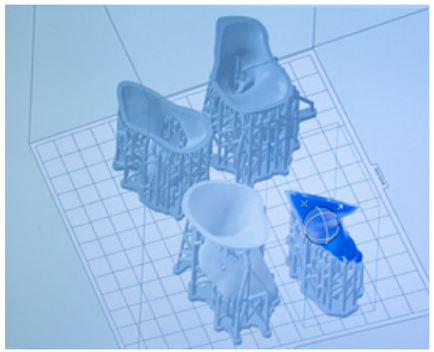
- Harvard Medical School, US
- Imperial College London, UK
- ISMETT- IRCCS, Palermo, IT
- Magdi Yacoub Foundation, Egypt
- MitrAssist Lifesciences, PRC
- Università degli Studi di Palermo, IT
- Università degli studi di Padova, IT
- Université de Technologie de Compiègne, FR
- University College London, UK
- University of Amsterdam, the Netherlands
- University of Bristol, UK
- University of Minnesota, US
- University of Pittsburgh, US

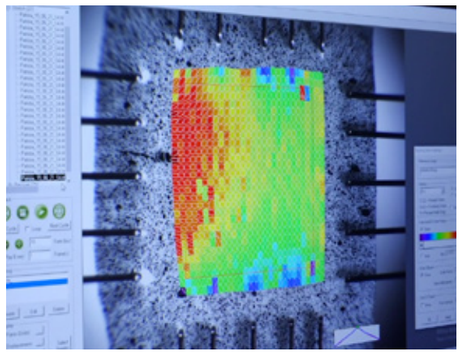
The Bioengineering Platform is equipped with state of the art facilities for the treatment and characterisation of biomaterials, the numerical simulation of complex physiological systems, and the preclinical validation of medical devices of the different classes (from class I to class III).
Our research team offers solid expertise in numerical modelling, fluid-structure analysis, design optimisation of medical devices, and pre-clinical evaluations complying with regulatory requirements and good practice. The platform is consolidating as a reference for healthcare providers, academic groups and small and medium-sized enterprises in the region, contributing to stimulate the implementation of clinical innovations emerging from the local excellence and providing the necessary professional training to generate new technical and business competencies in the field.

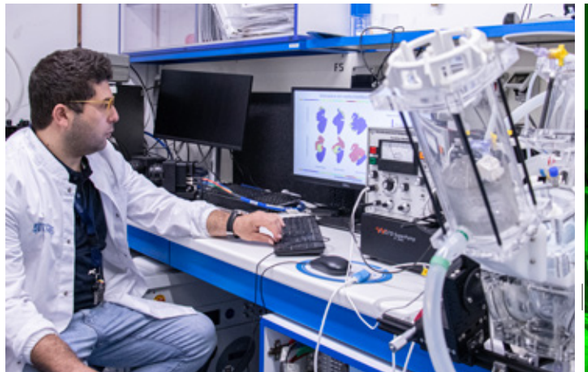
EXPERTISE
- Mechanical, thermo-mechanical and rheological characterisation of biomaterials and biofluids
- Numerical simulation of physiological systems and their interaction with medical devices (by means of structural, fluid-dynamic and fluid-structure interaction analyses)
- Development of numerical codes for the study of cardiovascular problems (e.g. simulation of thrombosis)
- Development of support tools for therapeutic planning
- Development of advanced diagnostic solutions
- Design of medical devices
- Hydrodynamic and structural *in vitro* characterisation of physiological systems and cardiovascular implants

TECHNOLOGY PLATFORM
- Codes for the numerical simulation of complex physiological systems (developed in house and commercial)
- Equipment for the treatment and characterisation of biomaterials and biofluids
- Tools for the basic manufacturing of components and prototypes
- Instruments for the preclinical validation of cardiovascular medical devices

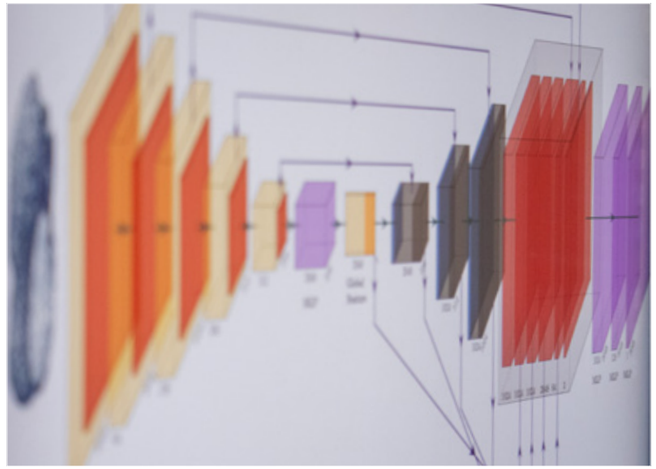


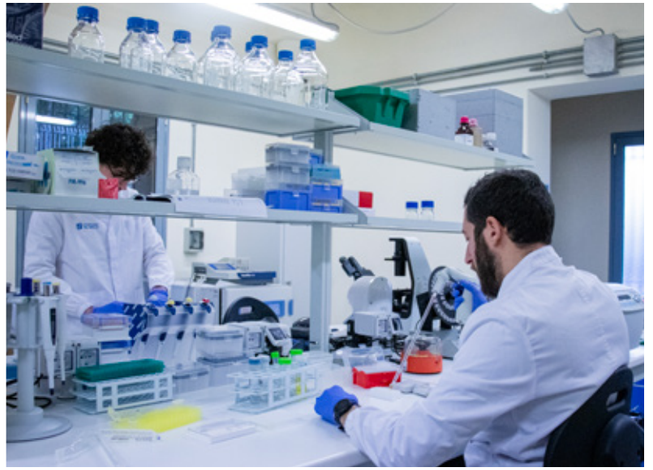


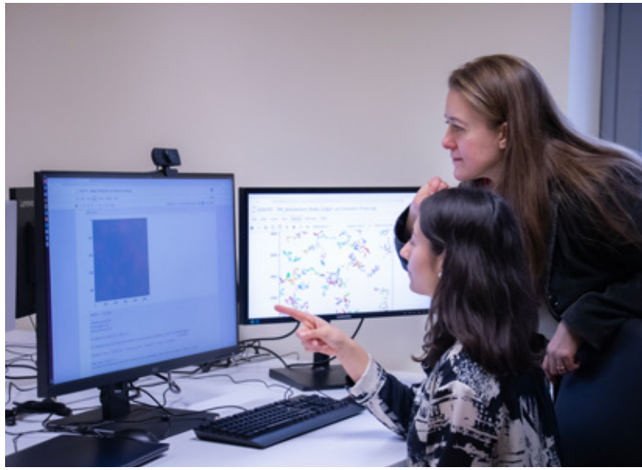




Bioinformatics
PLATFORM







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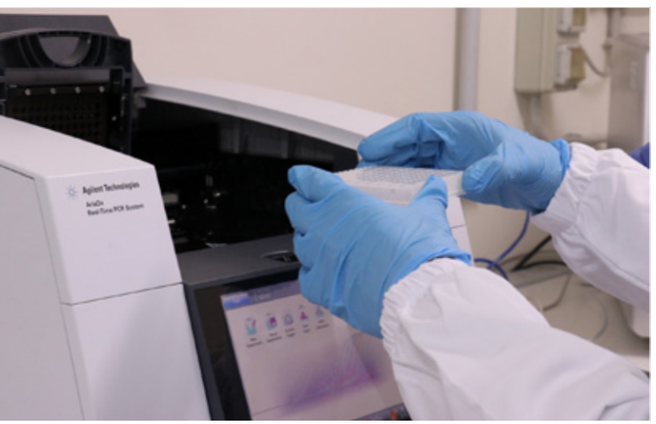
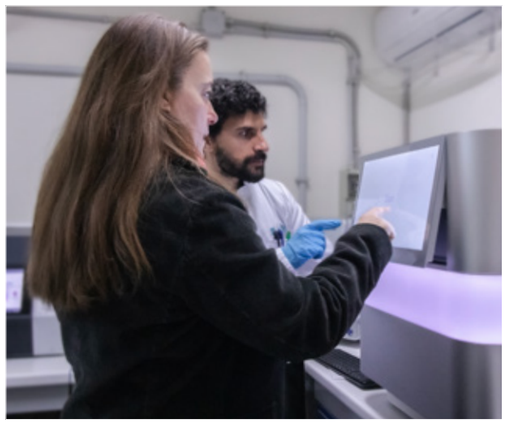
- Politecnico di Torino, IT
- Consiglio Nazionale delle Ricerche
  IRIB, Palermo IT
  IGM, Pisa, IT
  IFC, Pavia, IT
- ISMETT – IRCSS, Palermo, IT
- Fondazione D34health

The Bioinformatics platform develops algorithms to unravel omics data, from wet-lab to publication-ready results. Our scripts for data analysis are realized with open-source language, i.e., R and Phyton. When interested in specific pathologies or experimental conditions, we often take advantage of the large existing data repositories, such as GEO and Arrayexpress, where huge high throughput datasets are published. On the other hand, we also assist researchers in the design of experimental protocols and the analysis of the generated datasets, with custom curated methods.

In addition, we are also able to generate novel transcriptomic/genomic data, by using the new sequencing technology developed by Oxford Nanopore and Illumina. To this end, the platform is equipped with a Cellular and Molecular Biology lab, used also to validate computationally predicted biological interactions.

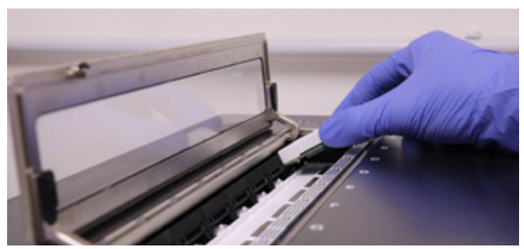




EXPERTISE
- Descriptive and inferential statistics.
- Development of customized data analysis pipelines.
- Machine learning and deep learning–basedpredictive algorithms, e.g. microRNA target prediction.
- Genomics/epigenomics/transcriptomics data generation (using Illumina and Oxford Nanopore technologies) and analysis (preprocessing, secondary and tertiary analyses)
- Single-cell RNA sequencing and data analysis

TECHNOLOGY PLATFORM
Computational lab
- 3 high performance computing workstation
- Server – CPU: 2x Xeon Gold 6152 2.10 GHz 22 Cores RAM: 128GB
- Server – CPU: 2x AMD Epyc 7402 24 Cores 2.8GHz RAM: 256GB HDD: 3x 480GB SSD GPU: 2x Nvidia A100 40GB

Experimental Lab
- Basic Cellular and Molecular Biology lab
- Qiagen QIAcuity Digital PCR System
- Oxford Nanopore PromethION 24
- Illumina NextSeq2000
- 10X Chromium X

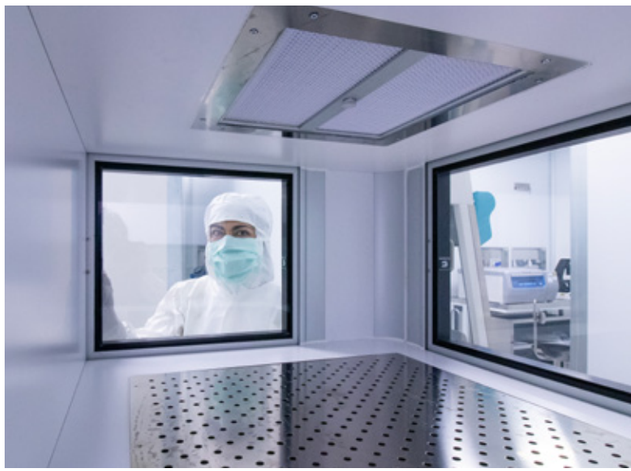


ACTIVE RESEARCH PROJECTS

SunFOX/SMART
These two projects were funded by the National Center 3 – RNA Gene Therapy and focus on the design and validation of antisense oligonucleotides (ASOs). Their respective goals are the down-regulation of the FOXO4 gene and the modulation of the aberrant splicing of the LMNA gene, which leads to progerin production.

Castor&Pollux
An infrastructure project funded through a cascade call by the D34Health initiative. It aims to develop a platform for characterizing organoids and 3D cultures via single-cell RNA-seq analysis. The funding includes upgrading the platform with equipment for single-cell library generation and a new dedicated computing server.

Cell Factory



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PARTNERSHIPS AND COLLABORATIONS

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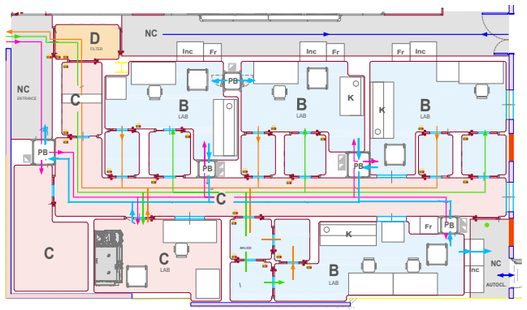
- ISMETT-IRCCS policlinico San Matteo, Pavia, IT
- ISMETT-IRCCS Ospedale Galeazzi-Sant'Ambrogio, IT
- University of Pittsburgh, Pittsburgh, US



GMP Facility Layout, with personnel and material flows

The new cell factory guarantees flexibility in the type of production and functionality of the different areas. The design of production and quality control layouts for advanced therapies (gene therapy, cell therapy, tissue engineering and combined ATMPs) was approved by AIFA during a Scientific Advice meeting. There are 4 class B laboratories, one of which allows for a higher containment and has an autoclave for waste treatment. The other 3 class B laboratories can be used in a totally independent way, for the simultaneous preparation of three different products. Alternatively, they can be connected two by two. In the last case, part of the operations can be performed in one lab and other manipulations can be performed in the second lab, passing the intermediate product through a pass box.

An additional class C room is used for cell preparation in specific closed systems. Maintenance can be performed without access to the production rooms, as the engines of the equipment protrude into technical areas. The Quality Control laboratories are equipped to conduct all the tests on raw materials, intermediates and final products required for product release. These labs can receive and adequately store reagents, materials and products according to GMP. Production areas and QC labs are equipped with a remote monitoring system.

EXPERTISE

- Set up of a GMP compliant Quality Assurance System
- Definition of GMP production protocols
- Development of Quality Control Methods
- Validation of environment, equipment, products
- GMP Training

ACTIVITIES

The facility is being qualified. The cell factory staff will carry out the validation of fundamental general processes (gowning validation, sanitization and clean hold time, passage of materials, etc.). Once the necessary development/ technology transfer data of the first advanced therapy products (adoptive immune therapies) are available, specific validation activities for the production process and related quality control methods will be carried out. A complete dossier on the first advanced therapy product and its intended clinical use will be submitted as an integral part of the manufacturing authorization application of the new facility.
Novel culture methods allowing minimal operators' intervention and automatic QC tests are being tested. Continuous activities include the maintenance of the GMP compliant Quality Assurance system and the periodic training of internal and external staff.

Biomedical Imaging and Radiomics
PLATFORM

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Corso Calatafimi 414, 90129 - Palermo, IT

PARTNERSHIPS AND COLLABORATIONS
- Georgia Institute of Technology (GIT), Atlanta, GA 30332, US
- National Institutes of Health (NIH), US
- Department of Health Promotion, Mother and Child Care, Internal Medicine and Medical Specialties, (PROMISE) University of Palermo, Palermo, IT
- Department of Engineering (DI), Bionanomaterials and Composites Laboratory, University of Palermo, Palermo, IT
- Pharmaceutical Factory, La Maddalena S.P.A., Palermo, IT
- Department of Biomedicine, Neuroscience and Advanced Diagnostics, (BIND)University of Palermo, Palermo, IT
- University Hospital Agostino Gemelli IRCCS, Rome, IT
- University of Catania, Catania, IT
- Ospedale Generale Regionale "F.Miulli", Bari, IT
- Nuclear Medicine, University of Messina, Messina, IT
- Biomedical Campus University of Rome, Rome, IT
- Medical Physics Unit, Cannizzaro Hospital, Catania, IT
- Nuclear Medicine Department, Cannizzaro Hospital, Catania, Catania, IT
- Department of Engineering, University of Palermo, Palermo, IT
- Experimental Zooprophylactic Institutes of Sicily (IZS Sicily), Palermo IT
- The Mediterranean Institute for Transplantation and Advanced Specialized Therapies (ISMETT-IRCCS), Palermo, IT
- Department of Agricultural, Food and Forests Sciences University of Palermo, Palermo, IT
- Institute of Bioimaging and Complex Biological Systems (IBSBC) CNR (Palermo and Milan)
- Texas A&M University – Corpus Christi, 6300 Ocean Dr, Corpus Christi, TX 78412, US

Biomedical Imaging and Radiomics Platform is primarily focused on oncology and neuroscience research. The Platform supports *in vitro*, *ex vivo*, and *in vivo* experiments, aiming for translation into the clinical application. Image analysis, artificial intelligence and radiomics tools are the driving forces of the platform, which are the basis for the entire workflow. The staff, which is currently increasing, is now comprised of scientific figures who possess transversal skills suitable for supporting the entire translational workflow, including experiments using cellular models and phantoms, scaffolds, tissues and organs within the RadioTheranostics and Biodiversity field. The scientific personnel on this platform are also trained in working with small animal models (mice and rats).

In 2025, the platform was implemented with the radiobiology laboratory (at Corso Calatafimi 414). The radiobiology laboratory, authorized to develop experiments using the following radionuclides such as Tc-99m, F-18, Cu-64, Ga-68, Lu-177, Ag-111, Zr-89 for research purposes, supported the RADIATION project won in June 2024 entitled "study and evaluation of the RADiobiological effect of innovative polymeric nanoparticles of natural origin radiolabeled with radioisotope Lu-177 in prostate cancer cell lines" and is continuing its study and development.
The laboratory is equipped with a Gamma Counter as well as Dynamic Light Scattering (DLS) instruments suitable for the design and characterizing the radioactive samples and the structure and stability of the nanosystems respectively.

EXPERTISE
- Image processing (MR, PET, CT, IVIS, HRCT, microscopy and histology), deep learning for 3D segmentation, radiomic to extract features and machine learning to prediction and classify of pathologies (for example, cancer, COVID19) and relapses as well as medical decision support.
- Conducting magnetic resonance imaging scans (T1, T2, DP, DWI, ADC, and DCE)
- Conducting positron emission tomography/computed tomography scans (PET/CT)
- Conducting spectroscopy scans on phantoms, *in vivo* samples, and *ex vivo* samples
- Biodistribution analysis of radiopharmaceuticals: preclinical molecular imaging
- Radiobiology assay, Radiopharmaceuticals application in Theranostics *in vitro* experiments
- Nanotechnology: Applications of nanoparticles in biomedicine
- Python, Matlab, CUDA

ACTIVE RESEARCH PROJECTS
- Synthesis and functionalization of nanoparticles with plasmonic effects for applications in cancer precision therapy in collaboration with the GIT and Texas A&M University
- Radiomic analysis of magnetic resonance angiography of mice suffering from a particular type of anemia in collaboration with the GIT
- Biodistribution studies of novel radiopharmaceuticals on preclinical PET models in light of the discovery of new PET ligands and neurological receptors, transporters and enzymes in collaboration with the GIT
- Radiobiology of Targeted Radionuclide Therapy: *in vitro* radiobiology studies on innovative radiopharmaceuticals through pharmacokinetic, trafficking and cell viability assays (RADIATIONS project) in collaboration with Department of Engineering (DI), Bionanomaterials and Composites Laboratory (UNIPA) and La Maddalena S.P.A.
- Preclinical PET and MRI studies to detect neuronal degeneration early in Parkinson's disease in collaboration with Institute of Bioimaging and Complex Biological Systems (IBSBC) CNR (Milan)
- *In vivo* biodistribution studies for the evaluation of the efficacy of the treatment of site-directed radiopharmaceuticals on a preclinical mouse model in diagnosis and theranostics (ISOLPHARM project) in collaboration with Institute of Bioimaging and Complex Biological Systems (IBSBC) CNR (Palermo)
- Innovative approaches to cancer treatment using metal nanoparticle-based therapies in collaboration with Texas A&M University.

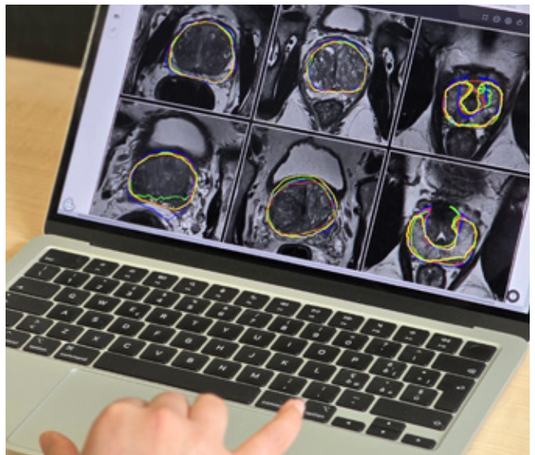
TECHNOLOGY PLATFORM
At Imaging and Radiomics Lab – Via Marini 14:
- Hardware: two workstations featuring 16-core Xeon CPUs, 128 GB RAM, 1x1TB HD SSD, 4x2TB HDs, and two Nvidia RTX8000 GPUs; one laptop with an Intel Xeon W-11955M CPU, 64 GB RAM, 1x2TB HD SSD, 3x2TB HDs, and two Nvidia A6000 GPUs.
- Software: PMOD, TopSpin, Paravision 6.1, Jmrui, Tarquin, Horos, 3DSlicer.

At Radiobiology Lab – Corso Calatafimi 414:
- Cell cultures and imaging: Incubator 37°C 5%CO2, Bioahazard laminar flow biological hood equipped with UV for cells, Thermostated bath, electrophoresis cells for sds page, transblot machine, inverted digital microscope, cell counter, 2 centrifuges with adapters, fluorescence 4-color/transmitted light and color applications, electrophoretic cells for SDS-PAGE, ChemiDoc MP Imaging System with accessories, Dynamic Light Scattering DLS. Other small laboratory equipment (e.g. scales, pH meter, aspirator, sonicator, pipets,..).
- Radioprotection and radioactivity detection: Chemical hood with edge for shielded vision and cabin for acids, bases and flammables, Comecer safe for radiopharmaceuticals, Plexiglass screen for Comecer beta emitters, anti-RX rays visual, Geiger counter, WIZARD 2470 gamma counter with 10 PerkinElmer detectors.
- Thermal cabins for material storage and cryopreservation: FRIDGE +4 °C, FREEZER -20°C, FREEZER -80°C, liquid nitrogen rack.

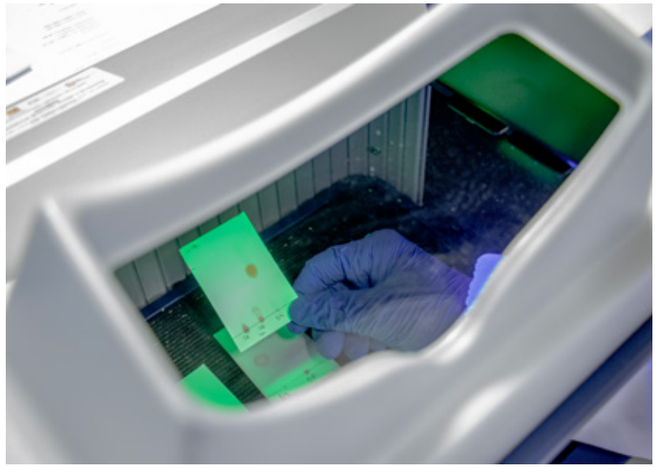
At Istituto Zooprofilattico Sperimentale:
- Bruker Pharmascan 70/16 (7 Tesla)
- IVIS Spectrum Advanced pre-clinical optical imaging
- microCT Skyscan 1276 CMOS Bruker

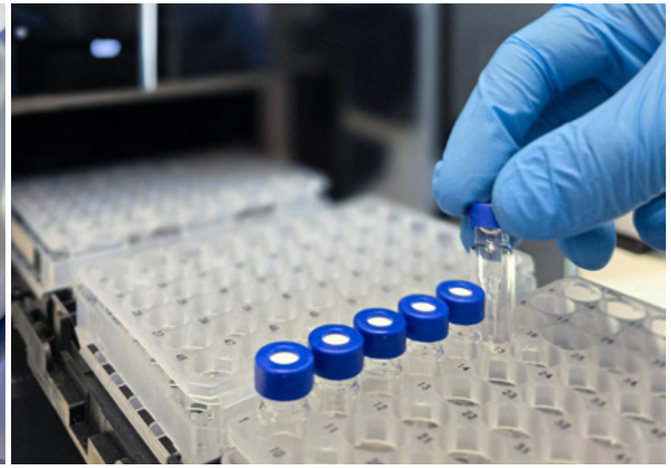
At IRCSS ISMETT
- GE DISCOVERY MR 750 W 3 Tesla High-Field Magnetic Resonance

At Institute of Bioimaging and Complex Biological Systems (IBSBC-CNR):
- PET/CT Clinical and Preclinical



Medicinal Chemistry
PLATFORM





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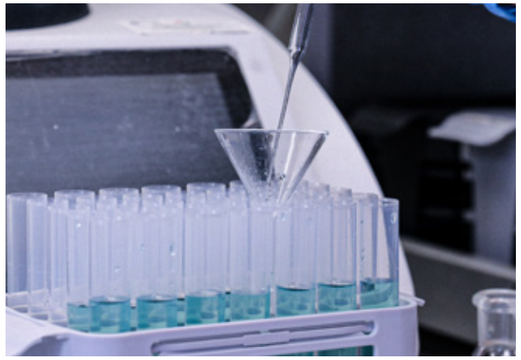
- Centro Cardiologico Monzino, Milan, IT
- The Mediterranean Institute for Transplantation and Advanced Specialized Therapies (ISMETT-IRCCS), Palermo, IT
- ChiBioPharAm Dept. University of Messina, IT

The design and synthesis of novel small molecules are the main objectives of the Medicinal Chemistry platform, leading to the creation of compound libraries and building block collections. The platform supports drug discovery campaigns, with the following activities: hit structure confirmation, hit re-synthesis, hit series expansion, structure optimization, and hit-to-lead. The main expertise covers the design, planning and development of synthetic routes, isolation, and structural elucidation of newly synthesized compounds. Moreover, structure-activity-relationship (SAR) studies help to explore the chemical space of the most promising hits to better profile the *in vitro* biological activity. The platform is fully equipped to support the work-flow from reactions set-up to isolation, analytical structure characterization, and purity grade assessment of the title compounds.

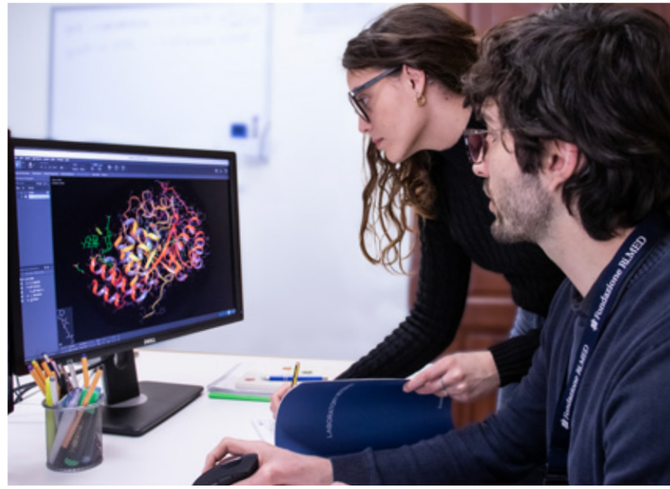
EXPERTISE
- Drug design
- Planning, development, and optimization of synthetic routes
- (Microwave-assisted) organic chemistry
- Purification of complex mixtures on normal and reverse phase
- Isolation of title compounds
- Structure elucidation and analytical characterization
- Purity grade assessment



ACTIVE RESEARCH PROJECTS
- Design and synthesis of potential inhibitors of NOD-like receptor family, pyrin domain containing 3 (NLRP3) inflammasome
- Early Drug Discovery to identify novel inhibitors of prenylcysteine oxidase 1 (PCYOX1), a novel target in cardiology and oncology

TECHNOLOGY PLATFORM
- Milli Q-3, Merck: Water purifier system for the production of pure and ultra-pure water (for analytical applications)
- Isolera One, Biotage: Flash chromatography apparatus for the isolation (on normal and reverse phase) of compounds of interest from complex reaction crudes
- Nexera, Shimadzu: High-performance liquid chromatography (HPLC) platform for semi-preparative applications and purity grade assessment
- LC-MS 2020, Shimadzu: Liquid chromatography-mass spectrometry platform for reactions monitoring and analysis of complex mixtures
- Discover 2.0, CEM: Microwave reactor for homogenous and heterogenous catalytic transformations
- Lyovapor L-200, Büchi: Lyophilizer for in vacuo drying, preserving the samples stability and integrity
- H-Cube Mini-Plus, StepBio: Flow reactor for catalytic hydrogenations, able to safely generate high-pressure hydrogen via water electrolysis
- Glass-Oven B-585, Büchi: Dryer for removal of residual organic solvents combining mild temperatures and vacuum

Molecular Informatics
PLATFORM



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PARTNERSHIPS AND COLLABORATIONS
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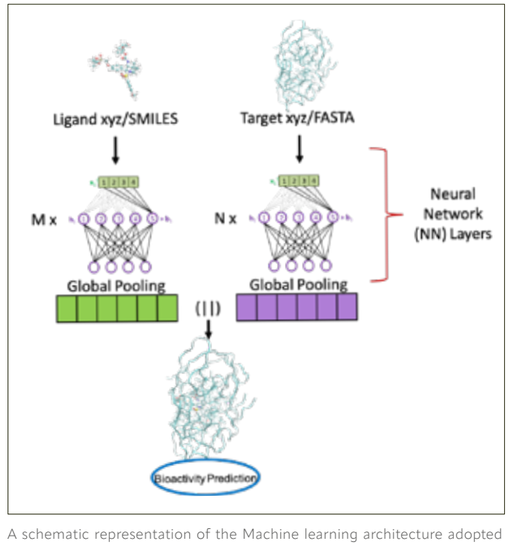
- Italian National Council of Research (CNR), IT
- University of Verona, IT
- University of Paris Citè, FR
- University of Palermo, IT



A schematic representation of the Machine learning architecture adopted by the group for the bioactivity assessment of xenobiotics (Molecular Informatics project ongoing) .

The Molecular Informatics platform focuses on the identification, characterization, and optimization of biologically active molecules using advanced *in silico* techniques. Its methods range from classical molecular modeling and virtual screening to the integration of modern chemoinformatics with proprietary tools. The team's collective expertise is leveraged to create molecular libraries, develop and validate reliable theoretical models, and perform subsequent virtual ligand screening (VLS). The platform also plays a key role in exploring and expanding chemical space to generate optimal molecular libraries for biological screening. Recent collaborations with academic groups from the University of Palermo, Verona, Paris, and Vienna have led to the development of AI-based approaches for predicting the activity of small molecules. Additionally, the compound management system within the platform automates the preparation of screening plates from in-house molecular libraries, based on virtual screening results.

ACTIVE RESEARCH PROJECTS
- Development of selective inhibitors of NOD-like receptor family, pyrin domain containing 3 (NLRP3), Epigenetics modulators and Prenylcysteine Oxidase 1 (PCYOX1)
- Deep learning-based drug repurposing
- Design of protein-protein interaction modulators
- Bioactivity prediction of Xenobiotics through chemoinformatics approaches
- Computer-aided molecular design of DNA and RNA G-quadruplexes stabilizers

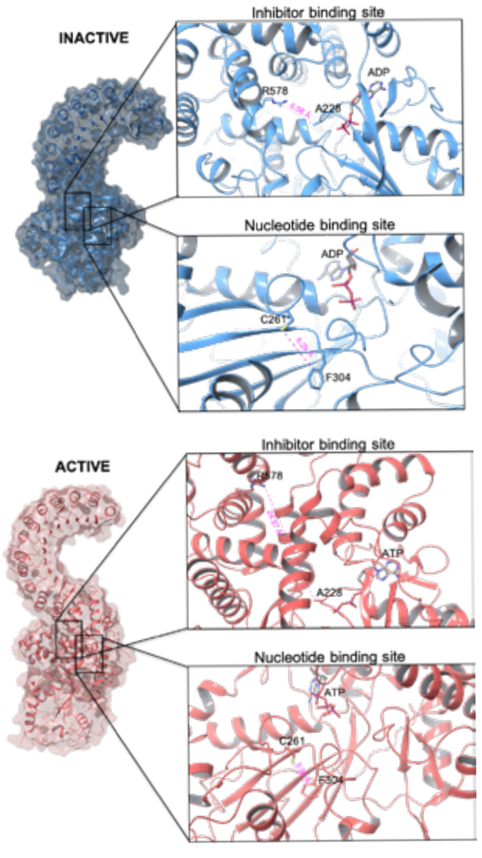
EXPERTISE
- Structure- and ligand-based virtual screening
- Computer-assisted Molecular Design and optimisation
- Chemical Database creation and management
- Chemical data mining
- Machine Learning in Drug Design
- AI application to biomolecular interaction studies
- Compound Management (plates design and preparation)

TECHNOLOGY PLATFORM

Software
- Schrödinger suite for small molecule drug discovery
- Schrödinger suite for biologics drug discovery
- LigandScout expert suite
- Autodock and Autodock Vina
- AlvaDesc/AlvaModel
- DESMOND (OPLS2005 and OPLS3e, OPLS4)
- AMBER
- NAMD
- VMD
- GROMACS
- KNIME

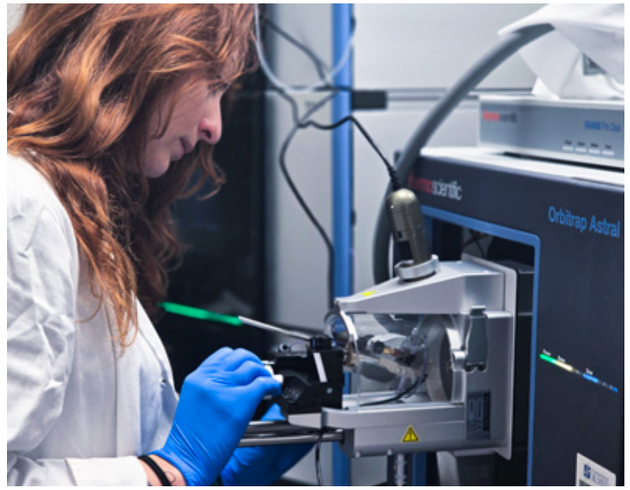
Hardware
- 5 Workstations GPU equipped
- Server: 80 cores e 2 x NVIDIA Tesla K80
- Server: 96 cores e 2 x NVIDIA A100
- Hamilton compound storage (up to 80K compounds)
- Hamilton liquid handler for plates preparation

Integrated in Silico Platform
The group is actually working at the creation of an integrated platform for molecular network analysis in collaboration with the Bioinformatics group.



The transition from inactive to active conformation of the NLRP3 Protein involved in chronic inflammation (Drug discovery project ongoing)

Proteomics
PLATFORM



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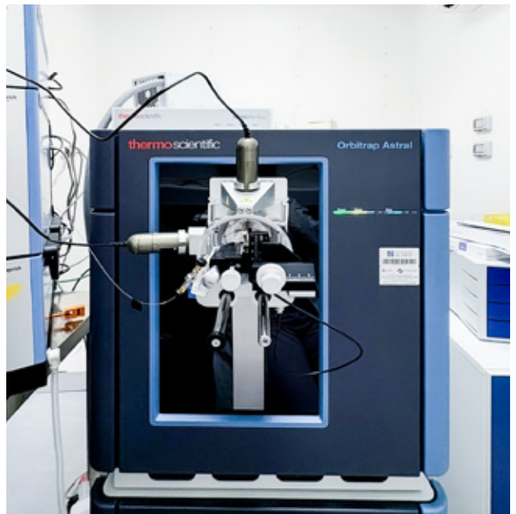
- University of Palermo, IT
- IRIB-CNR, Palermo IT
- University of Pisa, IT
- University of Udine, IT
- Istituto Ortopedico Rizzoli, IT
- German Center for Neurodegenerative Diseases (DZNE) Munich, DE
- Hospital for Special Surgery, Weill Cornell University, NY, US
- University of East Anglia, Norwich UK
- University of Nottingham, UK
- University of Liverpool, UK
- Tokyo University of Agriculture and Technology, JP
- University of Sousse, TN



The proteome represents the complete set of proteins expressed by a cell, tissue, or organism. The systematic, high-throughput study of proteomes, known as proteomics, enables the identification and quantification of proteins and their relative abundance in biological samples. Proteomics also allows for the analysis of differentially regulated proteins across various conditions. Proteomic applications in preclinical and clinical research are extensive, encompassing the identification of novel drug targets, the discovery of disease-associated biomarkers, and the prediction of drug-induced side effects. To support these efforts, Ri.MED has established a state-of-the-art proteomics platform for protein identification and characterization. This platform supports internal research, fosters collaborative studies, and provides services to academic research labs and industry partners.

ACTIVE RESEARCH PROJECTS
- Investigating the role of iRhoms in pancreatic ductal adenocarcinoma (PDAC)
- Development of a proteomics-based framework for sheddome-wide assessment of iRhom2 inhibitors
- Proteomic profiling of pancreatic cyst fluid and FFPE PDAC biopsies for the identification of diagnostic biomarkers of pancreatic cancer
- Perfusomics: a proteomic approach to assess donor organ graft quality and predict transplantation outcomes

Ri.MED has established a state-of-the-art proteomics platform equipped with advanced instrumentation, including an Astral, an Exploris 480, and a Q Exactive mass spectrometer, coupled with Vanquish Neo UHPLC and UltiMate 3000 RS LCnano systems. These cutting-edge technologies enable high-resolution, high-sensitivity quantitative proteomic analyses.

Specifically, the platform allows for the chromatographic separation of peptides generated through proteolytic digestion of complex protein mixtures, followed by electrospray ionization and tandem mass spectrometry (MS/MS). The resulting fragmentation patterns—mass spectra defined by unique mass-to-charge (m/z) ratios—serve as molecular fingerprints for peptide identification. Computational analysis of these spectra enables the inference and quantification of individual proteins present in the original sample.

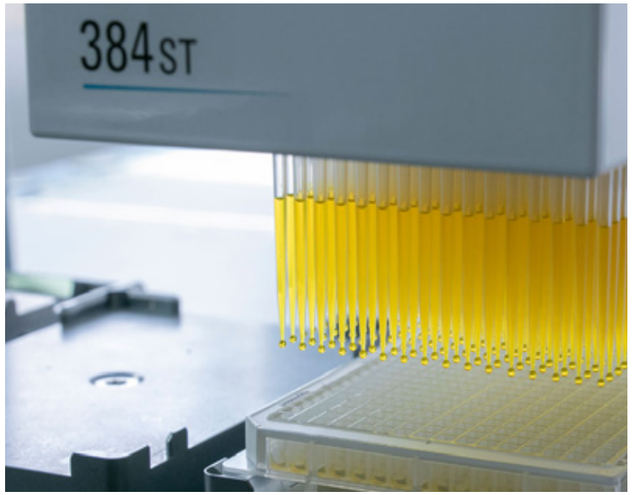
Beyond identification, Ri.MED's instrumentation and dedicated software infrastructure support robust quantitative proteomics, making it possible to compare protein abundance across different biological conditions or experimental groups.
Complementing the proteomics facility, Ri.MED also houses fully equipped laboratories for biochemistry and cell culture. These labs support upstream sample preparation and downstream validation of proteomic findings using orthogonal, immuno-based techniques

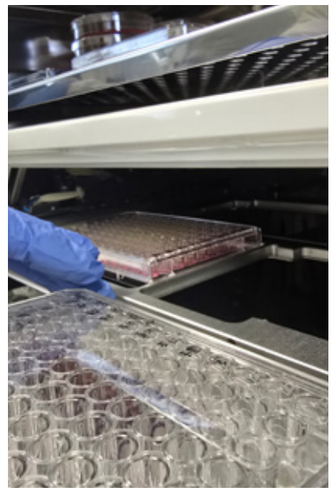
Ri.MED's proteomics platform provides cutting-edge tools and expertise, enabling researchers to conduct high-quality proteomic studies that drive advancements in health and biotechnology research.

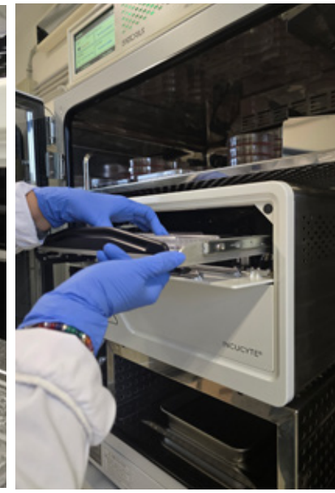
TECHNOLOGY PLATFORM
- Vanquish Neo uHPLC system connected to an Orbitrap Exploris 480 mass spectrometer
- Vanquish Neo uHPLC system on-line coupled to an Astral mass spectrometer
- Ultimate 3000 HPLC system connected to a Q-Exactive mass spectrometer
- Field Asymmetric Ion Mobility Spectrometry (FAIMS) Pro Interface for HPLC
- BeatBox®: Tissue homogenizer and cell lysis instrument for semi-automated sample homogenization of cells and tissue
- Comprehensive software for data analysis (e.g., Proteome Discoverer software)
- Fully equipped laboratory for biochemical validation of proteomics results

EXPERTISE
- Project planning
- Sample preparation using FASP, SP3, and iST methods
- Protein identification from in-gel or in-solution samples
- High-resolution LC-MS/MS for protein identification and quantification in complex mixtures
- Data acquisition using DDA and DIA methods
- Data analysis and visualization, including Perseus, R, and Gene Ontology analysis

Screening
PLATFORM







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PARTNERSHIPS AND COLLABORATIONS
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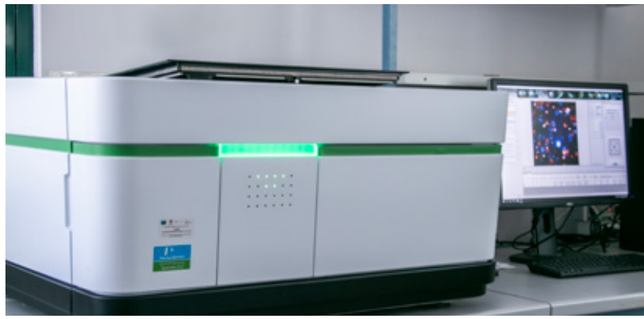
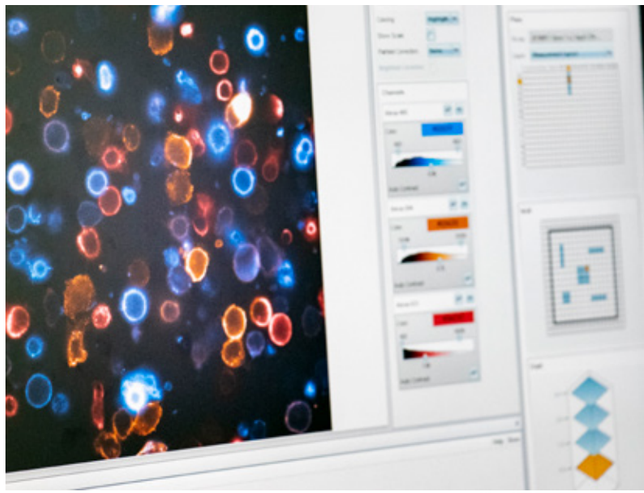
- National Research Council (CNR), IT

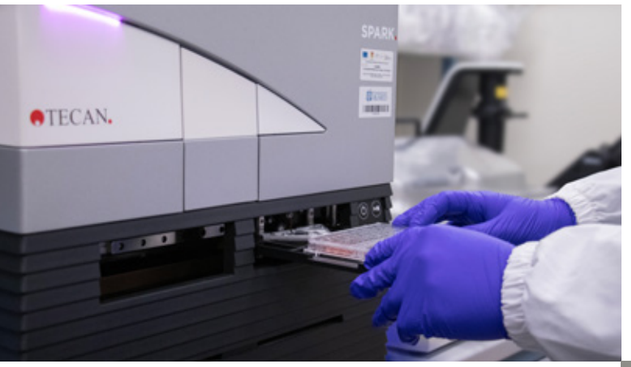
The screening platform provides labs and expertise for the development, miniaturization and validation of biochemical and cellular assays for the screening of libraries of small molecules. Our instrumentation allows the setup of flexible and partially automated protocols using a variety of readouts including absorbance, luminescence, fluorescence, TR-FRET, BRET and imaging. Our lab is equipped with a high-content screening (HCS) system combined with software for image analysis and data evaluation. The platform supports Drug Discovery projects by performing both primary screening as well as dose-response curves, orthogonal and secondary assays.

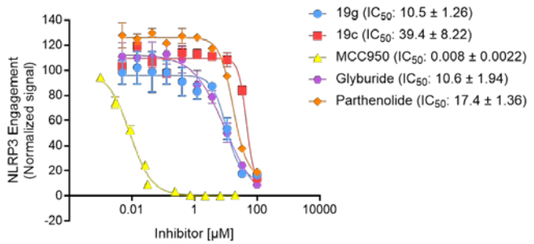
EXPERTISE
- Set-up and validation of primary assay (cell-free and cell-based);
- Different readouts possible including absorbance, luminescence and TR-FRET;
- Assay miniaturization (384-well plates);
- High-content imaging (HCI);
- Screening/high-content screening (HCS);
- Data analysis and primary active selection;
- Orthogonal and secondary assays;
- Toxicity tests.

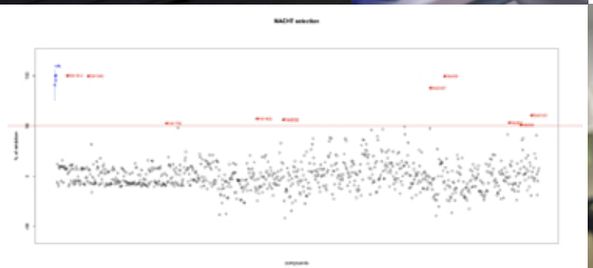
TECHNOLOGY PLATFORM
- Wet lab for cell and molecular biology;
- In-Hood-Bravo (Agilent) - liquid handling system;
- Spark (Tecan) - multimode microplate reader;
- Incucyte S3 (Sartorius) Live-Cell Analysis System;
- EL406 (Biotek) – automatic microplate washer/dispenser;
- Operetta-CLS (Perkin Elmer) –high-content imaging (HCI) system





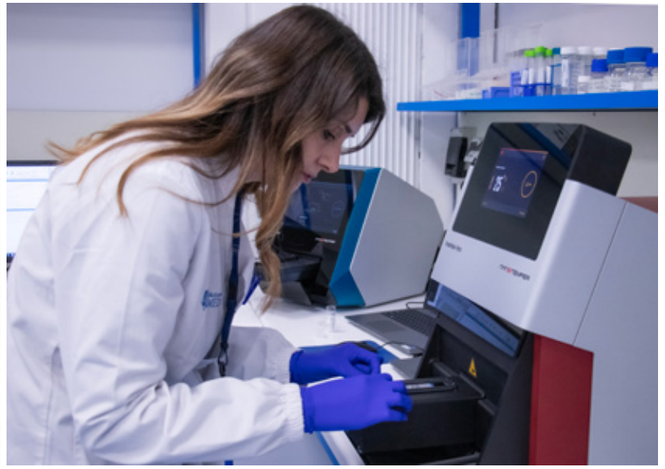


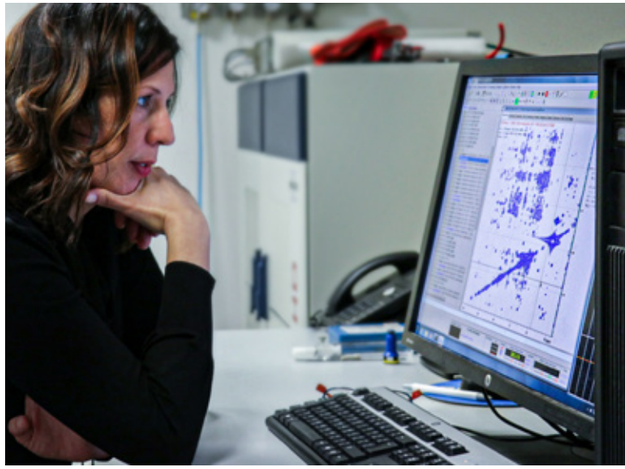




ACTIVE RESEARCH PROJECTS
- Discovery of selective inhibitors of the NOD-like receptor protein 3 (NLRP3) inflammasome for the treatment of chronic inflammatory diseases.
- NABUCCO "Nuovi farmaci e biomarkers di risposta e resistenza farmacologica nel cancro del colon retto"

Structural Biology and Biophysics
PLATFORM





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PARTNERSHIPS AND COLLABORATIONS
- Biophysics Institute of the National Research Council (IBF-CNR), Palermo, IT
- University of Palermo, IT
- University of Campania "Luigi Vanvitelli", Naples, IT
- European Brain Research Institute (EBRI) Rita Levi Montalcini, Rome, IT
- King's College London, London, UK
- i3S - Instituto de Investigação e Inovação em Saúde, Universida de do Porto, Porto, PT

The Structural Biology and Biophysics Platform supports the identification and characterization of biological targets, as well as studies of protein-protein and protein-ligand interactions. Leveraging state-of-the-art equipment, the platform employs a multi-technique approach, including high-field nuclear magnetic resonance, circular dichroism, isothermal titration calorimetry, interferometry, and fluorescence spectroscopy, complemented by molecular biology and computational approaches.

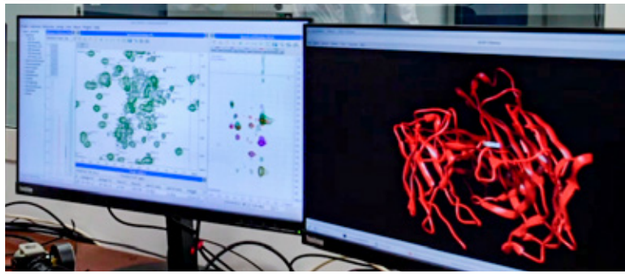
The Platform contributes to projects across various therapeutic areas, including neurodegenerative diseases, cancer, and infectious diseases. It provides support at multiple stages of research, from molecular biology manipulation to the production of high-purity recombinant proteins for structural and biophysical studies, and from structural characterization of proteins to studies of the kinetics and thermodynamics of protein-protein and protein-ligand interactions.

The platform's broad expertise and diverse project portfolio highlight its key role in advancing both basic and translational science.

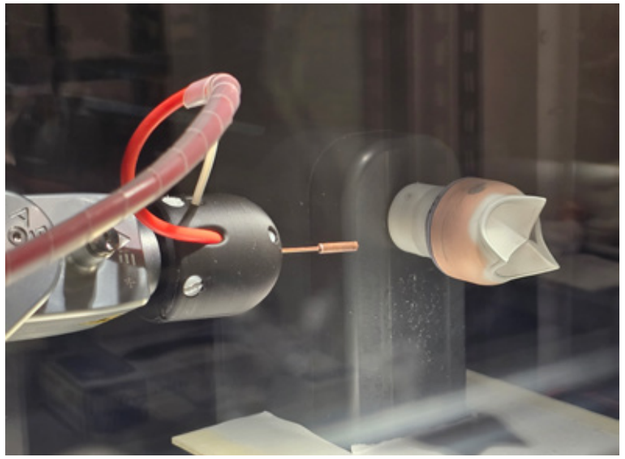
EXPERTISE
- Proteins Production: from cloning to purified and characterized proteins, including the production of uniformly or selectively labeled proteins.
- Determination of size, structure, and stability of biomolecules.
- Structural, kinetics, and thermodynamics studies of protein-protein and protein-ligand interactions.
- Fragments-based screening.
- Development and application of costumed analytical assays

TECHNOLOGY PLATFORM
- Molecular biology laboratories for recombinant protein production according to the most modern techniques for cloning, expression, and purification.
- AVANCE NEO 800 MHz NMR spectrometer equipped with cryo-probe – Bruker.
- MicroCal PEAQ_ITC – Malvern Panalytical.
- Bio-Layer Interferometer Octet Red96 – Sartorious.
- CD Spectropolarimeter J-1500 – JASCO.
- Multi-mode high-performance Microplate Reader CLARIOstar Plus – BMG Labtech.
- Monolith X – Nanotemper Technologies.
- Prometheus Panta – Nanotemper Technologies.

ACTIVE RESEARCH PROJECTS
- Discovery of selective inhibitors of the NOD-like receptor protein 3 (NLRP3) inflammasome for the treatment of chronic inflammatory diseases.
- New drugs and biomarkers for response and pharmacological resistance in colon cancer.
- Identification and characterization of interactions among SARS CoV-2 RTC and host proteins.
- Molecular mechanisms of protein misfolding diseases.
- Development of nontoxic bio-adhesives for wet environments.



Tissue Engineering
PLATFORM



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Ed.18/A Tissue processing platform
Ed. 16 Tissue characterization platform

PARTNERSHIPS AND COLLABORATIONS

- University of Palermo, Palermo, IT
- Advanced Technologies Network Center (ATeN Center), Palermo, IT
- McGowan Institute for Regenerative Medicine (MIRM), Pittsburgh, US
- University of Pittsburgh Medical Center (UPMC), Pittsburgh, US
- The Mediterranean Institute for Transplantation and Advanced Specialized Therapies (ISMETT-IRCCS), Palermo, IT
- Universidad Abierta Interamericana (UAI), Buenos Aires, Argentina, AR
- Neoolife, Pittsburgh, US
- TELEA BioTech, Sandrigo, IT
- Columbia University Irving Medical Center (CUIMC), New York, US
- Technical University of Munich, (TUM), Munich, DE
- University of California Irvine (UCI), Irvine, US
- Eindhoven University of Technology, Netherland, NL
- Politecnico di Torino, IT
- Università di Cagliari, IT
- Policlinico di Milano, IT
- Campus biomedico, Rome, IT
- Università Cattolica del Sacro Cuore, Roma, IT

The Tissue Engineering program aims to maintain a world class and financial sustainable tissue engineering platform at Ri.MED with a focus on clinical translation. The interest of this research platform is upon clinical applications where few effective solutions exist, with an emphasis upon unmet clinical needs in cardiovascular diseases. The bioprocessing and tissue engineering core platform offer disruptive tools for prototyping and assessing scaffold and biomaterials for tissue engineering applications. The platform aims to address a broad spectrum of needs within the IRCCS-ISMETT, UPMC Italy and Ri.MED cluster as well as supporting existing and prospective collaborative efforts with investigators at the McGowan Institute, and Pittsburgh departments of bioengineering and surgery.

ACTIVE RESEARCH PROJECTS

- **Tissue-engineered heart valves**
- Bioinspired mitral valve with chordal apparatus to address secondary regurgitation
- Bioinspired stent-less pulmonary valve to address congenital malformation
- Integrated AI – robotics – deposition target system for advanced polymer processing
- **Tissue-engineered vascular grafts**
- Bioinspired vascular graft to address dialysis access, coronary bypass, critical limb ischemia
- Esophageal graft
- Porta vein flow control system
- Scaffold-less vascular graft and microgravity
- **Tissue-engineered cardiac patches**
- AI assisted design of minimally invasive, bioinspired cardiac patch as bridge therapy for heart transplantation
- Soft tissue patches with reduced seroma production for breast reconstruction

- **Bioreactors for enhanced extracellular matrix elaboration**
- Chordae tendineae mechanobiology and engineering to address chordal rupture
- **Native/engineered tissue image-based structural and histopathological analysis**
- Imaging and image analysis methods for organoids, assembloids and embryos
- Development of automated, AI based analysis tool to detect biological networks from vasculature to actin filament scales
- **Native/engineered tissue numerical models for mechanics and tissue growth**
- Elucidating the impact of topological cues on cell and tissue growth
- Engineered tunica intima for reduced thrombogenicity of blood contacting devices

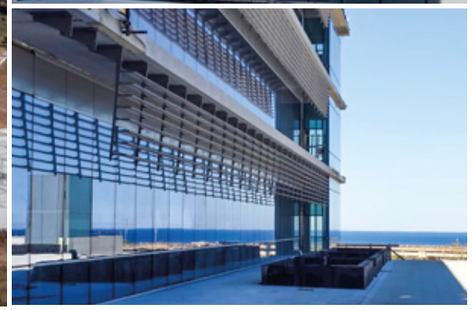
EXPERTISE

- Material biofabrication including: polymer, gel, metal and cell printing; near and far field electrospinning (ES); electrowriting (MEW); double component deposition (DCD);
- Polymer and gel synthesis;
- Decellularization of organs and tissues;
- Physical, and chemical characterization of native and engineered tissues;
- Qualitative and quantitative histological evaluation of native and engineered tissues;
- Controlled drug release;
- *In silico* and *in vitro* mechanobiology models;
- Structural deterministic models for tissue growth and scaffold degradation;
- Pre-clinical evaluation in small and large animal models;
- Numerical simulation of physiological systems and their integration with medical devices;
- FDA class II and III medical devices prototyping and assessment.

TECHNOLOGY PLATFORM

- Rapid prototyping, electrodeposition and 3D printing of polymer, gel, cells, plastic and metal Prusa mk4,
- Anycubic Kobra 2 max,
- TRUMPF TruPrint 1000,
- EnvisionTEC P4K,
- Adv. solutions BioAssemblyBot ,
- Custom-made electrospinning device,
- Chemical flow hoods,
- Polymer synthesis and extraction of extracellular matrix from organ and tissue: (Chemical flow hoods,
- Peristaltic pump - MasterFlex,
- Lyophilizer,
- Shaking incubator - SciQuip,
- Milling machine
- **Histology, biological assays and microscopy:**
- Embedding station - MicroLab,
- Microtome machine MicroLab,
- Nikon optical microscope Stativo ECLIPSE Ts2R-FL,
- ZEISS EVO 10 Scanning Electron Microscope,
- LEICA Stellaris DIVE 8 Multiphoton);
- **Biomechanical characterization of native and engineered tissue including:**
- INSTRON UNIAXIAL 68 TN10 tensile, compression, shear, torsion;
- Custom-made biaxial, bending test, pulsatile flow and stretch bioreactors;
- **Software for quantitative histology, surface and volume biomaterials analysis:**
- Image-Based Tool to Experimentally Evaluate Blood Residence Time in Clinical Devices: (Menallo et al. 2024) an open-source tool to experimentally compare blood residence time in biomedical devices using an image-based method;
- BVD (Blood Vessel Detection): an open source, automated blood vessel detection and quantification on transversal tissue sections for tissue engineering and quantitative histology (Adamo et al., 2023);
- Collagen-rich area segmentation & quantification: custom algorithm (D'Amore et al., 2018) based on k-means clustering (k=4) to segment images into background, ECM, VSMCs, and scaffold, with iterative intensity-based refinement.
- Fiber Network Topology Characterization tool (Pitt invention disclosure ID#02193, copyrighted software, filed 04/2010; D'Amore et al.): method to characterize the complete fiber network topology of planar fibrous tissues and scaffolds;
- Advanced quantitative histology pipelines cell growth and morphology characterization and quantification, explant morphology and microstructure characterization.
- **FEA and CFD to simulate physiological systems and their integration with medical devices**
- Abaqus, Comsol, Ansys CFD,
- AMD DUAL EPYC WKS SERIES I

WORK IN PROGRESS



Ri.MED Research Center

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