1. Supervisor(s)

Supervisor: Roberta Censi – School of Pharmacy (https://farmaco.unicam.it)

Dr. Roberta Censi is an Assistan Professor in pharmaceutical and biomaterials sciences at the University of Camerino (UNICAM) and also Vice Director of the School of Pharmacy (UNICAM). Her research focuses on biopolymers, nanomedicine, drug delivery systems, and biofabrication technologies for biomedical and pharmaceutical applications. Her work spans the design and synthesis of polymeric materials, nanoparticle-based drug delivery, hydrogel systems for tissue engineering, and biofabrication technologies such as 3D bioprinting. These platforms are applied to areas including regenerative medicine, neuroregeneration, and antimicrobial biomedical coatings. Dr. Censi has extensive experience in European collaborative research programmes, particularly within European Commission initiatives such as Marie Skłodowska-Curie Actions (MSCA). She has coordinated and participated in numerous international research projects and networks focused on nanomedicine and advanced biomaterials. In addition to her academic activity, she is co-founder and Vice-President of Recusol Srl, a spin-off company of the University of Camerino dedicated to the translation of biomaterials research into biomedical applications. She has supervised 22 PhD students, 6 of which conducted their doctoral studies within MSC programmes. Her research is highly interdisciplinary, integrating polymer chemistry, pharmaceutical technology, nanotechnology, and biomedical engineering, and is supported by strong collaborations with leading European research institutions and hospitals.

Research Output

Total number of publications: 92 peer-reviewed scientific publications in the fields of biomaterials, drug delivery, and pharmaceutical technology.

ORCID: 0000-0002-7036-1990

Selected Significant Publications

1. Censi, R. et al. 2011. *Advanced Functional Materials*. (IF 19.9, first author)

2. Firouzabadi B. M, et al. (2025). *European Journal of Pharmaceutics and Biopharmaceutics.* (IF 4.3, Last Author)

3. Casadidio, C. et al. 2023. *International Journal of Pharmaceutics*, 636. (IF 6.5, last author)

4. Salathia, S. et al. 2026. *Pharmaceutical Research* (IF 4.3, last author)

5. Censi, R. e al. 2008. *Journal of Controlled Release* (IF 11.5, first and corresponding author)

Funded Projects and Research Grants

Over the past decade, Dr. Censi has secured 4 national and 9 international funded projects.

Major National Grants:

- Fondo Italiano per le Scienze (FIS II) – Consolidator Scheme. Project: OSTEOTHER – Local nanoparticle-mediated drug delivery for effective osteosarcoma-targeted therapy. Funding body: Ministero dell'Università e della Ricerca. Role: Principal Investigator. Budget: €1.3 million
- Fondo Italiano per le Scienze Applicate (FISA). Project: ADMIRE – Advanced Antimicrobial Surface Coatings for Biomedical Applications. Funding body: Ministero dell'Università e della Ricerca. Role: Principal Investigator. Budget: €1.3 million

- PRIN 2022 – Progetti di Ricerca di Rilevante Interesse Nazionale. Project: TANDEM – Tackling neurodegeneration with by-product-based nanohydrogels for nose-to-brain delivery of natural bioactive compounds. Role: Principal Investigator
- POR Marche FESR 2014–2020 – Regional Innovation Programme. Project in the area of Health and Well-Being. Role: Principal Investigator

Major European Research Projects

- MSCA-ITN NOVA-MRI – Novel Applications in 19F Magnetic Resonance Imaging. Role: Coordinator
- MSCA-ITN CAST – Active Monitoring of Cancer as an Alternative to Surgery. Role: Principal Investigator
- MSCA-ITN PIANO – Nanoparticle-Based Imaging and Therapy of Chronic Pain in the Dorsal Root Ganglia. Role: Principal Investigator
- MSCA-ITN ISPIC – Image-Guided Surgery and Personalised Postoperative Immunotherapy to Improve Cancer Outcome. Role: Team Member
- MSCA-RISE CANCER – Personalised Postoperative Immunotherapy to Improve Cancer Outcome. Role: Team Member
- MSCA-RISE PRISAR2 – Proactive Monitoring of Cancer as an Alternative to Surgery. Role: Team Member
- MSCA-RISE SENATOR – Magnetic resonance imaging using nanomaterials and perfluorocarbons. Role: Team Member
- MSCA-RISE CHARMED – Green microenvironment and its impact on health and well-being in the elderly. Role: Team Member
- Horizon Europe LIFE Programme. Project: Complex Awareness Raising and Behaviour Change for the Mercury-Free City Environment. Role: Principal Investigator

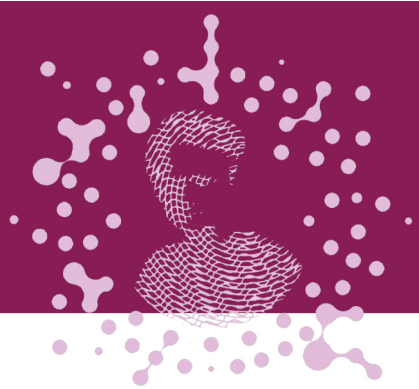
Awards and Recognition (selection)

- Invited Speaker at the 10th Anniversary Conference of the Hellenic Society for Biomaterials (Athens, Greece).
- Chair and Invited Speaker at the 6th International Conference on Tissue Engineering (Heraklion, Greece).
- Invited Speaker and Abstract Evaluator at the Annual Meeting of the Controlled Release Society (Las Vegas, USA).
- Invited Speaker at webinars organized by the Controlled Release Society – Italy Chapter.
- Invited Speaker at the Controlled Release Society Annual Conference 2025 (Philadelphia, USA).

Contact: roberta.censi@unicam.it

Co-Supervisor: Cristina Casadidio – School of Pharmacy (https://farmaco.unicam.it)

Dr. Cristina Casadidio is an Assistant Professor specializing in biomaterials, drug delivery systems, nanomedicine, and hydrogel-based therapeutic platforms for biomedical applications. Her research focuses on the development of advanced biomaterials for controlled drug delivery, regenerative medicine, and



targeted therapies, including injectable hydrogels, polymeric nanoparticles, and gene delivery systems. Her work integrates pharmaceutical technology, polymer chemistry, and biomedical engineering, with applications in infection control and regenerative medicine. She has contributed to the development of stimuli-responsive hydrogels, nanoparticle-based therapeutics, and gene delivery platforms, addressing key challenges in targeted drug delivery and translational biomaterials research. Dr. Casadidio has participated in several international collaborations and research projects, including research training at Utrecht University (Netherlands), where she worked on advanced hydrogel systems for therapeutic delivery. She has supervised 3 PhD students and she is actively involved in international scientific networks and regularly presents her research at major conferences in biomaterials and pharmaceutical sciences. Her research contributes to advancing innovative biomedical technologies aligned with the priorities of Horizon Europe and the European research agenda in health and advanced materials.

Research Output

Total number of publications: 24 peer-reviewed scientific publications in the fields of biomaterials, drug delivery, and pharmaceutical technology.

ORCID: 0000-0002-3925-7087

Selected Significant Publications

1. Firouzabadi B. M, et al. (2025). *European Journal of Pharmaceutics and Biopharmaceutics.* (IF 4.3, Corresponding Author)

2. Casadidio C*, et al. (2025). *Journal of Controlled Release.* (IF 11.5, First and Corresponding Author)

3. Casadidio C*, et al (2023). *International Journal of Pharmaceutics.* (IF 5.2, First and Corresponding Author)

4. Casadidio C, et al (2023). *Molecular Pharmaceutics*. (IF 4.5, First Author)

5. Casadidio C, et al. (2018). *European Journal of Pharmaceutics and Biopharmaceutics*. (IF 4.3, First Author)

Funded Projects

- Fondazione Veronesi Post-doctoral Fellowship 2024" assigned to excellent scientists by Fondazione Umberto Veronesi, organization founded in by Prof. Umberto Veronesi

Awards and Recognitions (selection)

- Julia Polak European Doctorate Awards 2024 Issued by European Society for Biomaterials, 2024
- "Honorable Mention" as an influential citizen for 2024 from the Municipality of Tolentino Issued by Tolentino Municipality, September 2024
- 1st prize – Best Thesis award UIPS 2023 Issued by Utrecht Institute for Pharmaceutical Sciences (UIPS), April 2022
- 1st prize EUFEPS European PhD student competition 2023. Issued by European Federation for Pharmaceutical Sciences (EUFEPS). Lisbon (Portugal), June 2023

Contact: cristina.casadidio@unicam.it

2. Research Group and Facilities

Laboratory & Facilities: Dr. Censi and Dr. Casadidio supervise three fully equipped laboratories within the Chemistry Interdisciplinary Project at the University of Camerino. The laboratories are dedicated to polymer synthesis, nanomedicine, biomaterials characterization, and biofabrication technologies.

Major equipment includes:

- Differential Scanning Calorimetry
- Dynamic Light Scattering (with zeta potential module)
- Two advanced rheometers (normal force, UV crosslinking, tribology)
- BIOX 6 3D bioprinter
- Microfluidic device
- Computer-aided micro-tomography
- Isothermal calorimetry
- Optical microscopy systems
- Franz diffusion cells
- Complete skin-analysis platform (VapoMeter, Moisture Meter, Antera 3D CS, Sebometer, pH-meter, colorimeter)
- Freeze dryer and spray dryer
- Sonicator and Ultraturrax
- Ultracentrifuge

The research group also has access to centralized institutional facilities including NMR, HPLC, SEM, XRD, FTIR, cell culture laboratories, and animal facilities, enabling comprehensive material characterization and biological validation.

Research Network: Dr. Censi leads a multidisciplinary and international research group integrating expertise in chemistry, nanotechnology, pharmaceutical sciences, biology, and biomedical engineering.

The group currently includes:

- 1 Assistant Professor (Dr. Casadidio)
- 8 PhD students
- 2 Postdoctoral researchers
- Visiting researchers and Erasmus students

The group collaborates with several leading international institutions, including:

- Utrecht Institute for Pharmaceutical Sciences
- Ghent University

- University Medical Center Utrecht
- University of Minnesota
- Charité – Universitätsmedizin Berlin

These collaborations support joint research projects, exchange of researchers, and interdisciplinary training in biomaterials, drug delivery, and regenerative medicine.

3. Research Thematic Area/Project Idea

Title of the project: *Smart stimuli-responsive hydrogel platforms for precision treatment of chronic wounds through controlled antimicrobial and pro-healing therapeutic delivery*

Macroarea:

MSCA Panel: Life Sciences (LS)

Primary Panel: LS7 – Prevention, Diagnosis and Treatment of Human Diseases

Keywords: Stimuli-responsive hydrogels; biomaterials; chronic wound therapy; diabetic foot ulcers; antimicrobial resistance; drug delivery systems; regenerative medicine; tissue engineering; smart biomaterials; nanomedicine; personalized medicine.

Research Domain: Biomedical materials, nanomedicine, drug delivery systems, and regenerative medicine for chronic wound management.

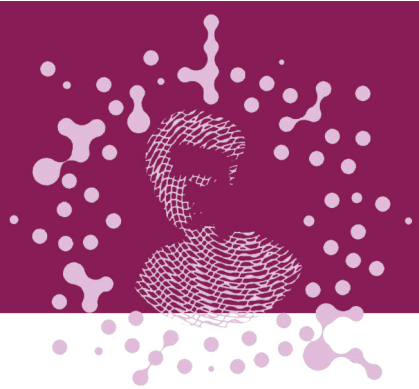
Project Overview:

Chronic wounds, including diabetic foot ulcers and pressure ulcers, remain a major healthcare challenge across Europe. These conditions are associated with prolonged inflammation, microbial infection, impaired angiogenesis, and delayed tissue regeneration. Current therapeutic approaches rely primarily on conventional wound dressings and systemic antibiotic administration. However, these treatments often demonstrate limited effectiveness due to inadequate drug localization, rapid drug clearance, frequent dosing requirements, and increasing antimicrobial resistance.

Recent advances in biomaterials science have highlighted the potential of hydrogel-based wound dressings as multifunctional platforms capable of maintaining a moist environment, protecting damaged tissue, and delivering therapeutic agents directly to the wound site. In particular, stimuli-responsive hydrogels have emerged as promising materials because they can dynamically respond to local physiological conditions such as pH changes, enzymatic activity, temperature variations, or bacterial metabolites. These materials offer the possibility of on-demand drug release, enabling improved infection control and enhanced tissue repair.

Despite these advances, several key limitations remain in the current state-of-the-art:

- Many hydrogel systems lack precise control over drug release kinetics.
- Existing wound dressings often provide only antimicrobial activity without promoting tissue regeneration.
- Limited integration of multifunctional therapeutic strategies combining infection control and regenerative signaling.



- Insufficient translation of advanced biomaterials from laboratory research toward clinically relevant wound therapy.

The proposed project addresses these gaps by developing next-generation stimuli-responsive hydrogel systems capable of delivering both antimicrobial agents and pro-healing therapeutics in a controlled and localized manner. The innovation of this project lies in the integration of smart biomaterials design, responsive drug delivery, and regenerative medicine strategies within a single therapeutic platform.

The hydrogel systems will be designed using biocompatible polymers such as chitosan, cellulose derivatives, and methacrylic acid, enabling tunable mechanical properties, controlled swelling behavior, and programmable degradation profiles. By incorporating stimuli-responsive elements sensitive to wound microenvironment signals, the system will enable targeted and controlled release of antimicrobial drugs and growth-promoting molecules, thereby addressing infection while simultaneously promoting tissue regeneration.

This interdisciplinary approach combines biomaterials engineering, pharmaceutical drug delivery, and regenerative medicine, contributing to the advancement of innovative therapeutic strategies for chronic wound management. The project therefore represents a significant step forward toward precision biomaterial-based wound therapy, supporting the development of safer and more effective treatments aligned with European healthcare priorities.

4. Candidate and Career Plan

Expected background of the candidate

The candidate, Dr. Maryam Aftab, holds a PhD in Biochemistry and Molecular Biology from COMSATS University Islamabad, complemented by an MPhil in Biochemistry from Quaid-e-Azam University Islamabad and a Doctor of Pharmacy degree from Riphah Institute of Pharmaceutical Sciences. Her academic background combines pharmaceutical sciences with molecular biology, enabling a multidisciplinary approach to biomedical research, particularly in drug delivery systems, nanomedicine, and biomaterials.

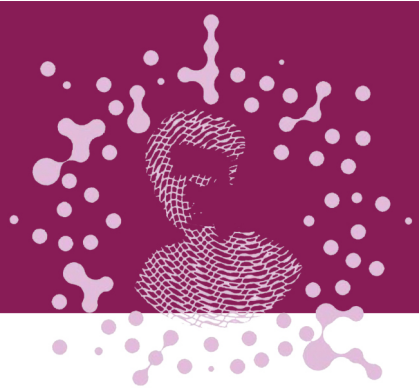
Her doctoral research focused on the development of injectable hydrogel systems for the sustained release of antinarcotic drugs such as naltrexone, addressing challenges in drug addiction treatment through advanced biomaterial design. This work integrates polymer chemistry, pharmaceutical formulation, and controlled drug delivery mechanisms.

Dr. Aftab has an established publication record with numerous peer-reviewed articles in international journals covering topics such as smart hydrogels, nanoparticle-based drug delivery, nanomaterials for wound healing, 3D bioprinting, and nanomedicine. Her research outputs demonstrate strong expertise in biomaterials engineering, nanotechnology-based therapeutics, and biomedical applications of polymeric systems.

In addition to her research achievements, she has gained teaching and supervisory experience as an Assistant Professor at Rawalpindi Women University and research experience at the Nanomedicine Laboratory of National University of Medical Sciences. These roles have strengthened her mentoring, project management, and collaborative research skills.

Her technical expertise includes:

- Development and characterization of polymeric and hydrogel-based drug delivery systems



- Nanoparticle and nanomaterial-based therapeutic platforms
- Drug release kinetics and mathematical modeling of pharmaceutical formulations
- Spectroscopic and biochemical analytical techniques including UV-spectrophotometry and ELISA
- In silico drug safety and bioavailability analysis
- Statistical data analysis and visualization using R programming

Overall, the candidate brings a strong interdisciplinary background spanning biochemistry, pharmaceutical sciences, nanomedicine, and biomaterials research, making her well-positioned to contribute to advanced biomedical innovation under the MSCA Postdoctoral Fellowship.

Competences and knowledge to be developed by the candidate

Through the MSCA Postdoctoral Fellowship program, the candidate will further strengthen her scientific profile by acquiring advanced competences in emerging biomedical technologies, interdisciplinary collaboration, and translational research.

Scientifically, the fellowship will enable the candidate to expand her expertise in advanced biomaterials and nanotechnology for biomedical applications. She aims to develop deeper knowledge in areas such as:

- Advanced nanomedicine and targeted drug delivery systems
- Functional biomaterials for regenerative medicine and therapeutic applications
- Advanced biofabrication approaches including 3D and 4D bioprinting technologies
- Translational approaches for biomaterial-based therapeutics in clinical contexts
- Integration of nanotechnology with immunotherapy and vaccine delivery platforms

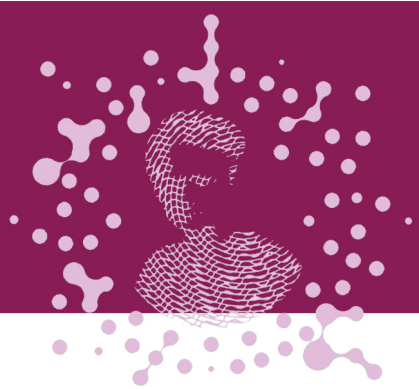
The project will also allow the candidate to strengthen her methodological capabilities, particularly in:

- Advanced characterization techniques for biomaterials and nanoparticles
- Computational modeling and predictive analysis of drug delivery systems
- High-throughput biological assays and molecular analysis
- Integration of experimental and computational approaches for drug development

Beyond scientific expertise, the fellowship will contribute to the development of several transferable skills, including:

- Leadership and independent research management
- International collaboration and interdisciplinary teamwork
- Research dissemination and science communication to diverse audiences
- Grant writing, project development, and innovation management
- Technology transfer and intellectual property awareness in biomedical research

By acquiring these competences, the candidate will enhance her ability to conduct high-impact interdisciplinary research and contribute to the advancement of biomedical technologies for healthcare applications. The fellowship will support her progression toward becoming an independent researcher



capable of leading innovative research initiatives at the intersection of nanomedicine, biomaterials, and pharmaceutical sciences.