

DC1: Synthesis of antimicrobial peptidomimetics and polymer nanomaterials for biofilm degradation and treatment

Host institution: [Sapienza University of Rome](#), Rome, Italy

Supervisor: [Prof. Iolanda Francolini](#)

Co-supervisors: Prof. Luciano Galantini (Sapienza University of Rome); Prof. Maurizio Prato (CIC biomaGUNE)

Project description: The persistence of wound infections is strongly linked to bacterial biofilms, which protect pathogens from antimicrobial agents and contribute to antimicrobial resistance. Conventional treatments rely on sequential biofilm disruption and antibiotic administration, but often fail to fully eradicate infections and may promote resistance.

This PhD project focuses on the development of novel antimicrobial peptidomimetics and polymer-based nanomaterials to overcome these limitations. In particular, the project will explore the design and synthesis of peptide and polymer amphiphiles as stable, tunable analogues of antimicrobial peptides, alongside amphiphilic polymer nanostructures that act as nanocarriers for targeted delivery within biofilms.

A key objective is to integrate multiple functionalities within nanoscale systems by combining antimicrobial peptidomimetics with biofilm-disrupting agents (e.g. EPS-degrading enzymes). This approach aims to enable simultaneous biofilm penetration, disruption, and bacterial killing. The project will place strong emphasis on understanding structure–property relationships through advanced physicochemical characterisation.

The doctoral candidate will be trained in synthetic chemistry, self-assembly of functional nanomaterials, and antimicrobial evaluation. The outcomes will contribute to the development of next-generation nanotherapeutics for biofilm-associated infections within the broader HEAL-4WARD programme.

Host laboratory: The DC1 will be hosted by the Laboratory of Polymeric Materials at the Department of Chemistry of Sapienza University of Rome, one of the largest and most prestigious research universities in Europe. The laboratory research activity focuses on the synthesis and physicochemical characterisation of antimicrobial and antioxidant polymers for biomedical and industrial applications and design of polymeric and hybrid nanoparticle systems for drug delivery.

The laboratory is equipped with state-of-the-art facilities for polymer synthesis and characterisation, including FTIR, DSC, TGA, Instron and contact angle measurements, and has access to departmental and University infrastructure including X-ray scattering system SAXS (SAXSLab Sapienza), a 600 MHz NMR spectrometer (Sapienza NMLAB), a departmental NMR service (Lab Orione, equipped with a Bruker Avance NEO 400 Nanobay liquid-state NMR spectrometer), a SCIEX QTRAP 6005+ mass spectrometer, an advanced platform for nanoscale synthesis and electrochemical characterisation based on Atomic Force Microscopy (PESCA), an integrated FTIR microscopy system for time-resolved chemical imaging (microFTIR), and a microfluidic viscometry instrument. These are complemented by high-performance computing platforms equipped with dedicated software for computational chemistry (scientific computing cluster 6DOT). The Department also co-manages the Research Centre for Nanotechnology Applied to Engineering (CNIS), which provides additional instrumentation including high-resolution Field Emission Scanning Electron Microscopy and atomic force microscopy.

The group currently comprises three PhD students, two postdoctoral researchers and several Master's students, fostering a dynamic and collaborative scientific environment. It coordinates or participates in several research projects commissioned by national institutions and industries operating in the field of polymeric materials. The doctoral candidate will therefore benefit from strong links to groups in polymer chemistry, nanomedicine and biology both within Sapienza and internationally.

Secondments: This project is carried out in collaboration with the following groups, and visits to their laboratories are expected during the project. A willingness to travel and spend time abroad is therefore essential:

- Prof. Mathias Destarac, Toulouse III - Paul Sabatier University, France
- Prof. Maurizio Prato, Centro de Investigación Cooperativa en Biomateriales CIC (biomaGUNE), Donostia-San Sebastián, Spain
- Prof. Marco Monopoli, RCSI University of Medicine and Health Sciences, Dublin, Ireland

Eligibility conditions:

- Master's degree in Chemistry, Industrial Chemistry, Chemical Engineering, Materials Science, Polymer Science, Nanosciences, or related fields.
- Applicants must be doctoral candidates, i.e. not already in possession of a doctoral degree.
- Mobility rule: researchers must not have resided or carried out their main activity in the country of the recruiting beneficiary for more than 12 months in the 36 months immediately before their recruitment date.

Required skills:

- Experience in synthetic chemistry and/or polymer chemistry (e.g. peptide synthesis, organic synthesis, or macromolecular design), ideally demonstrated through Master's thesis work or research internships.
- Familiarity with macromolecules, nanomaterials or self-assembled systems and physicochemical characterisation techniques (e.g. NMR, DSC, DLS, TEM, spectroscopy) would be beneficial; prior exposure to antimicrobial or biomaterials research is an advantage.
- Proficiency in the English language is required, as well as good communication skills, both oral and written. Successful candidates will need to provide an English test (e.g. IELTS, TOEFL, Cambridge English). You may be exempt if you are a national of a majority native-English speaking country, or have qualifications / degree that has been taught and assessed in English. The supervisor may also confirm that a candidate has the required level of English.

Remuneration:

The Doctoral Candidate will receive a gross yearly salary of ~EUR 54,378 in accordance with the MSCA Doctoral Networks programme, including a living allowance and a mobility allowance. This amount corresponds to the contractual gross salary and is indicated before deduction of employer costs, employee taxes and social security contributions. An additional family allowance (if applicable) is foreseen. The net salary will depend on local taxation, social security and employment regulations.

Enquiries:

For general information about the HEAL-4WARD Doctoral Network visit the project website (www.heal4ward.eu) or send an email to heal4ward@gmail.com. For additional information on this project please contact Prof. Iolanda Francolini (iolanda.francolini@uniroma1.it).

How to apply

To learn more about the application process, visit the HEAL-4WARD recruitment web page (www.heal4ward.eu/open-positions).

Required documents:

- Statement of interest (limit of 2,500 characters) explaining why you wish to be considered for the fellowship and which qualities and experience you will bring to the role.
- Curriculum vitae et studiorum.
- A certificate of University examinations taken (with marks).
- A final degree certificate translated in English. If, at the time of application, candidates should not be yet in possession of a degree certificate, they can submit it at the time of the examination. However, if successful, the candidate will be required to provide a translated and legalized certificate as proof of eligibility for doctoral admission.

A limited number of applicants will be invited for an interview and will be required to provide contact information of up to two contact person for reference letters.

Application deadline: The closing date for applications is **30 June 2026**.