

DC8: Involvement of polymeric nanostructures in the modulation of multispecies biofilms formed on chronic wounds

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

Supervisor: [Prof. Iolanda Francolini](#)

Co-supervisors: Prof. Luciano Galantini (Sapienza University of Rome); Dr. Alessandra Del Guidice (Sapienza University of Rome), Dr. Vincenzo Taresco (University of Nottingham)

Project description: Chronic wound infections are strongly associated with multispecies biofilms, where complex microbial communities contribute to persistent infections, delayed healing, and increased resistance to antimicrobial treatments. These biofilms typically involve both aerobic and anaerobic bacteria, whose interactions, spatial organisation, and adaptability make them particularly difficult to treat.

This PhD project focuses on investigating the role of polymeric nanostructures, both synthetic and natural, in modulating these multispecies biofilms. In particular, the project will explore how nanostructures influence key biofilm processes such as formation, structural organisation, intercellular communication, disruption, and antimicrobial resistance, including their potential role in early biofilm prevention and mature biofilm dispersion.

The research will combine microbiological and nanomaterials approaches. Bacterial species commonly isolated from chronic wounds will be used to develop multispecies biofilms. Their structure and spatial organisation will be analysed using advanced imaging techniques, including FESEM and confocal microscopy coupled with FISH. In parallel, polymeric nanostructures will be produced and characterised in terms of size, morphology, surface charge and stability.

A central objective is to assess how these nanostructures interact with biofilms and modulate their behaviour, including their potential to positively or negatively influence biofilm formation and resilience. Functional assays, together with Nanoparticle Tracking Analysis and imaging techniques, will be used to elucidate these mechanisms.

The doctoral candidate will be trained in microbiology, biofilm analysis and nanomaterials characterisation. The outcomes are expected to provide an improved understanding of multispecies biofilms in chronic wounds and support the development of novel nanostructure-based antibiofilm strategies within the HEAL-4WARD programme.

Host laboratory: DC8 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:

- Dr. Natalia Baranova, Centro de Investigación Cooperativa en Biomateriales CIC (biomaGUNE), Donostia-San Sebastián, Spain
- Dr. Vincenzo Taresco, School of Chemistry, University of Nottingham, Nottingham, UK
- Prof. Evangelos Giamarellos-Bourboulis, National and Kapodistrian University of Athens, Athens, Greece

Eligibility conditions:

- Master's degree in Nanoscience, Materials Science, Microbiology, Molecular Biology, Biomedical Engineering, 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 nanotechnology and/or biofilm research (e.g. bacterial culture, biofilm assays, aerobic/anaerobic techniques), ideally demonstrated through Master's thesis work or research internships.
- Familiarity with imaging and characterisation techniques relevant to biofilms and nanostructures (e.g. microscopy such as SEM or confocal microscopy, or particle analysis methods); experience with data analysis of biological systems would be beneficial.
- 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.heal-4ward.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.heal-4ward.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**.