



PhD in CHIMICA INDUSTRIALE E INGEGNERIA CHIMICA / INDUSTRIAL CHEMISTRY AND CHEMICAL ENGINEERING - 40th cycle

**INTERDISCIPLINARY Research Field: SELF-ASSEMBLY OF SHORT PEPTIDES TOWARDS
NOVEL ANTIMICROBIALS**

Monthly net income of PhDscholarship (max 36 months)

€ 1400.0

In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity

**Motivation and objectives of the research
in this field**

Interdisciplinary PhD Grant

The PhD research will be carried out in collaboration with research groups of the PhD programme in "**BIOENGINEERING**".

See <https://www.dottorato.polimi.it/?id=422&L=1> for further information..

As antimicrobial resistance (AMR) rages, flanked by the exhausted pipeline of new antibiotics, the search for alternative therapeutic options for the treatment of bacterial infections is ever more topical. While antimicrobial peptides (AMPs) present a promising solution, their clinical translation faces challenges such as high production costs, susceptibility to proteases, and potential toxicity to eukaryotic cells, hindering their progress. This project is dedicated to the development of i) innovative short AMPs capable of self-assembling into nanostructures with finely tuned antimicrobial and antibiofilm activity, and ii) cutting-edge bioengineered platforms to assess the efficacy of these AMPs in relevant contexts. By delving into the unexplored domain of short AMPs and ultrashort variants the objective is to address production cost concerns and enhance effectiveness. The precise manipulation of the AMPs' primary sequences will be undertaken to achieve the intended self-assembly and multifunctional characteristics.



<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>The AMPs library will be crafted starting from self-assembling di- and tri-peptides to strategically engineer custom sequences with tailored charge, hydrophobic content, and non-covalent interaction capacity, following established AMP design rules. Post-synthesis functionalization will be explored to enhance self-assembly, antimicrobial activity, and proteolysis resistance. Physicochemical characterization and examination of self-assembly properties will utilize mass spectroscopy, NMR, spectroscopic (UV-Vis, CD), scattering (light and X-Ray), and electron microscopy techniques. Structure-Activity Relationship (SAR) studies will correlate supramolecular features with interactions at bacterial barriers, growth inhibition, and broader antimicrobial effects. A 3D bacterial biofilm model will assess AMP activities. In vitro evaluation against resistant/non-resistant strains and potential eukaryotic cell toxicity will identify effective sequences and mechanisms. A co-culture platform simulating infections and hemolysis tests will further assess peptide compatibility and resistance mechanisms. The study will be conducted at SupraBioNano Lab, Biocell, and μBiomilano LAB (Dept. CMIC, Politecnico di Milano).</p>
<p>Educational objectives</p>	<p>The PhD candidate will gain strong expertise in both peptide science, in terms of design, synthesis and supramolecular features, as well as in the engineering of custom platforms for the study of antimicrobial and antibiofilm activity. The PhD program includes international stays in the Universidade da Coruña, Spain.</p>
<p>Job opportunities</p>	<p>This interdisciplinary provides a valuable training opportunity for the recruited Ph.D. student, offering exposure to various techniques and fostering adaptability and problem-solving skills of key relevance for future contributions to academia and industry.</p>
<p>Composition of the research group</p>	<p>2 Full Professors 4 Associated Professors 6 Assistant Professors 13 PhD Students</p>
<p>Name of the research directors</p>	<p>Prof.ssa C. Pigliacelli; Prof.ssa N. Bono</p>



Contacts	
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Web-pages of the research group: SupraBioNano Lab / BioCell	

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p>Educational activities (funding for participation in courses, summer schools, workshops and conferences) - financial aid per PhD student:</p> <p>1st year: around 1.900 euros 2nd year: around 1.900 euros 3rd year: around 1.900 euros</p> <p>Teaching assistantship: availability of funding in recognition of supporting teaching activities by the PhD student: There are various forms of financial of for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities within the limits allowed by the regulation.</p>