

Politecnico di Milano

PhD in Chimica Industriale e ingegneria Chimica

Research Title: Investigating the role of the physicochemical microenvironment in biofilm formation

Scholarships and Financial support	
Monthly net income of PhD scholarship (max 36 months)	€. 1300 (In case of a change of the welfare rates during the three-year period, the amount could be slightly modified)
Number of scholarships	1
Beginning of PhD	1 st February 2018
Deadline for application	11 th December 2017
Context of the research activity	
Motivations and objectives of the research in this field	Bacteria, despite being traditionally studied in the planktonic phase, are often found within sessile communities known as biofilms. In the environment, biofilms mediate the cycling of elements by retaining and transforming organic matter and stabilize sediments from erosion. Biofilms also grow on implanted devices such as stents, prosthetic cardiac valves and catheters, posing serious health threats and reducing the lifetime of these devices, and represent the most common cause of persistent and chronic infections given their dramatically increased resistance to antimicrobial agents. Nevertheless, unveiling the mechanisms underpinning the formation of biofilms remains largely an open challenge. In particular, physical and chemical factors of the environment such as fluid flow or the presence of nutrient gradients – which are ubiquitous in natural and artificial systems – have been little investigated, largely due to the lack of

	appropriate methodologies and quantitative frameworks. The goal of this project is to understand the role played by the physicochemical microenvironment in the formation of biofilms, in order to improve our ability to prevent, disrupt or manage biofilms in nature, technology, and health.
Methods and techniques that will be developed and used to carry out the research	The research activity will be primarily experimental and based on modern microfluidic methods, which enable exquisite control of fluid flow, direct observation of microorganisms down to single-cell resolution, and the spatiotemporal modulation of the chemical environment. Advanced imaging techniques and tracking algorithms will be implemented to directly visualize and precisely quantify bacterial behavior and biofilm development, while the use of available genetic mutants (in collaboration with the University of Nottingham, UK) will help to dissect the complexity of the biological response to environmental stimuli. This project will be carried out at the Humanitas Clinical and Research Center, in Rozzano (MI). Humanitas is a world-famous center of excellence for research and treatment of immune system-related disease, from cancer to cardiovascular diseases, equipped with imaging facilities at the forefront of technological innovation, enabling the realization of the most complex and demanding research projects.
Educational objectives	In this project, the student will learn a number of engineering approaches based on microfluidics, microscopy, image acquisition and image processing. The candidate will also have the opportunity of working in a highly interactive environment, at the interface between clinical and basic research.
Job opportunities	PhD graduates in this research field can find employment either in academia or in the private sector, like biomedical, biotechnological and food processing companies.
Composition of the research group	1 Associate Professor
Names of the research directors	Prof. Roberto Rusconi, Associate Professor of Applied Physics
Contacts	roberto.rusconi@hunimed.edu
Additional support	
<u>Housing:</u> financial aid per PhD student per year (gross amount)	<u>Foreign students* inserire solo se rilevante</u> 1 st year: 0 euros per student 2 nd year: 0 euros per student 3 rd year: 0 euros per student (max number of financial aids available...., given in order of merit) <u>Out-of-town residents (more than 80 Km out of Milano)</u> 1 st year: 0 euros per student 2 nd year: 0 euros per student

	<p>3rd year: 0 euros per student</p> <p>(max number of financial aids available...., given in order of merit)</p>
<p>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other informations</p>	
<p>The student will have a dedicated desk and computer in a shared workspace.</p>	