



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

THEMATIC Research Field: PRIN 2022 PNRR - DEVELOPMENT OF HIERARCHICAL  
POLYMER CONSTRUCTS FOR TARGETED BIOAPPLICATIONS

**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**

PRIN Bando 2022 PNRR. Prot. P2022Z7TEC - CUP  
B53D23024560001

The development of biomaterials with tunable properties and suitable macromolecular structure for the functionalization with specific motifs is a leading aspect in the implementation of novel tools for advanced bioapplications and for more effective health technologies. In particular, polymeric constructs at the macro, micro and nanoscale are still in demand as systems capable of resembling complex microenvironments and enabling selective interactions with bio/chemical molecules, towards the definition of the so-called in vitro 3D models and targeting therapies. The production of these polymer-based systems can be addressed via 3D printing technologies, batch and microfluidic strategies, starting from the synthesis or functionalization of polymers via different polymerization and conjugation methods (e.g., controlled living radical polymerizations, click chemistry, bio-conjugation).

The research to be carried out in this doctorate will be focused on the synthesis of polymeric materials from bio or semisynthetic sources and their use in the production of polymeric scaffolds (e.g., hydrogels) and nanoparticles via 3D printing or microfluidic processes for advanced bioapplications, such as immunotherapies, organotypic



	<p>models, controlled drug delivery.</p> <p>The implementation of these innovative materials will be carried out at the laboratory scale, with a look towards the optimization of the process for larger scale production.</p> <p>The research project is aligned with the strategic emerging topic of the PNRR, in particular related to the human wellbeing (Cluster 1 Health; Sub Cluster: 3) and for the Biotechnologies in Regenerative Medicine, Tissue Engineering and Personalized Medicine (PNRR Area 5.1.3) and Nanotechnologies for Nanomedicine (PNRR Area 5.1.4).</p> <p>It is partially funded by research project “Improving ovarian cancer immunotherapy by the combination of Discoidin Domain Receptor 2 blockade and bispecific antibodies targeting CD28 and tumour-associated antigens” - PRIN Bando 2022 PNRR. Prot. P2022Z7TEC - CUP B53D23024560001</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The PhD formation will be based on the application of the chemical engineering and applied physical chemistry concepts, starting from the experimental design, synthesis and validation of biocompatible polymers and, then, the use of the obtained materials in printing processes (e.g., extrusion-based process, two-photon polymerization) for the fabrication of 3D scaffolds, and in microfluidic devices for the production of smart nanocarriers for target drug delivery.</p> <p>The PhD will also work on the selection of the starting materials, the modification of the polymers with specific bio-motifs (e.g., peptide or antibodies) and chemical moieties.</p> <p>The PhD will apply printing and microfluidic principles to obtain the polymeric construct at the different scale.</p> <p>The aims of the research are relevant to PNRR Strategic Emerging Topic related to human wellbeing and effective health technologies.</p>
<p><b>Educational objectives</b></p>	<p>To form a PhD able to drive from the literature the design of innovative polymeric constructs to be used for advanced biomedical applications and their successful implementation, in particular through the exploitation of</p>



	3D printing and/or microfluidics
<b>Job opportunities</b>	The background of the PhD at the end of his/her pathway will allow a number of possibilities in chemical industry and research centers, with particular advantages in positions related to the development of new biocompatible polymers and design of product using additive manufacturing (e.g., biomedical, cosmetic, medical fields).
<b>Composition of the research group</b>	5 Full Professors 3 Associated Professors 3 Assistant Professors 16 PhD Students
<b>Name of the research directors</b>	Prof. D. Moscatelli, Dr. E. Mauri

#### Contacts

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 Email: emanuele.mauri@polimi.it  
 Web-pages of the research group: <https://www.cmic.polimi.it/ricerca/elenco-gruppi-di-ricerca/cfalab/>

#### Additional support - Financial aid per PhD student per year (gross amount)

<b>Housing - Foreign Students</b>	--
<b>Housing - Out-of-town residents (more than 80Km out of Milano)</b>	--

#### Scholarship Increase for a period abroad

<b>Amount monthly</b>	700.0 €
<b>By number of months</b>	6

#### **Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information**

**Confidentiality:** the management of Confidential Information, Results and their publication is subordinate to the agreement referred to PRIN PNRR 2020 projects.

**Educational activities** (funding for participation in courses, summer schools, workshops and conferences) - financial aid per PhD student per year: 1<sup>st</sup> year: around 1.900 euros per student 2<sup>nd</sup> year: around 1.900 euros per student 3<sup>rd</sup> year: around 1.900 euros per student

**Teaching assistantship:** availability of funding in recognition of supporting teaching activities by the PhD student: There are various forms of financial support 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.