

PhD in Materials Science and Technology

Smart nanobiomaterials and 3D technologies for advanced and personalised medical devices

Funded by	DISAT
	European Union under the Horizon 2020 research and innovation programme
	GIOTTO Project

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Context of the research activity	<p>The research activity will be framed in the context of the project - GIOTTO - funded by the European Union under the Horizon 2020 research and innovation programme (call H2020-NMBP-TR-IND-2018-2020) and coordinated by Politecnico di Torino (DISAT).</p> <p>The project is strongly multidisciplinary and involves several academic partners from excellent universities across Europe and high-tech SMEs and spin-off companies able to provide the right level of expertise and skills needed to bring research cutting-edge results close to the market.</p> <p>In particular, GIOTTO project will develop smart nano-biomaterials combined with additive manufacturing technologies and 3D printing to fabricate advanced medical devices aimed at the treatment of different types of bone fractures in people affected by osteoporosis. The GIOTTO devices will be bio-functionalised with an active biomolecule and will incorporate bioactive nanomaterials (containing therapeutic ions) able to favour a faster and effective healing of the fractured bones.</p> <p>Since the proportion of elderly people in European societies is increasing fast and will have important social and economic effects in the coming years, the development of scientific and technological innovations aimed at allowing active and healthy</p>
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	<p>aging is compelling. The smart nano-biomaterials and 3D technologies developed in the framework of GIOTTO project will provide innovative and personalized solutions for people affected by osteoporosis, thus contributing to mitigate the economic impact of this pathology on the health systems of European countries.</p> <p>Furthermore, the intensely interdisciplinary nature of the research activity will contribute to the cross fertilization between universities and business sector, boosting the innovation of the European SME operating in the field of nanomaterials, medical devices and 3D technologies.</p>
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Objectives	<p>The biofunctionalisation will be a key aspect for the manufacturing process of the final devices. In this regard, several strategies will be investigated to incorporate the biomolecules, among which the anchoring to the inorganic nanomaterials (nano-hydroxyapatite, mesoporous bioactive glasses) or to the resorbable polymeric phases (i.e. collagen, PLLA) used to fabricate the devices, or in alternative, the encapsulation within resorbable polymeric nanoparticles acting as carriers (i.e. cyclodextrin or PLGA).</p> <p>To target these objectives, the PhD fellowship will be mainly devoted to develop <i>ad hoc</i> strategies, which based on the specific device and the final applications, will allow to encapsulate and/or grafting the biomolecules and to release them with the needed kinetics and therapeutic concentrations, also under endogenous triggers (such as pH change).</p> <p>The adopted functionalisation routes will have to allow the retention of the biomolecule activity and this aspect will be fully assessed through several <i>in vitro</i> techniques, also in collaboration with the clinical partners of the project, and through the advanced optical facilities available at PolitoBIOMed Lab.</p>
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Skills and competencies for the development of the activity	<p>The competences of the successful candidate are:</p> <ul style="list-style-type: none"> - Expertise in the field of nanomaterial functionalisation for biomedical applications - Nanocarriers for functional molecules (dyes, drugs); - UV-vis and fluorescence spectroscopy; - Basic biomolecular techniques, immunohistochemistry methods, analysis of gene expression; - Western blot technique for protein analysis. <p>Skills on working in a team.</p> <p>Proactive approach to join a multidisciplinary research program and to spend time abroad in different laboratories.</p> <p>A background in nanobiotechnology will be considered a plus.</p>
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