



## PhD in DESIGN - 38th cycle

### INTERDISCIPLINARY Research Field: BIOFABRICATED MATERIALS AND PRODUCT DESIGN FOR THE ECOLOGICAL TRANSITION

#### Monthly net income of PhDscholarship (max 36 months)

€ 1195.0

In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, 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.

In recent years, the need to remedy the now undeniable and partly irreversible environmental damage caused by human activity has led to a new movement: Biodesign. Biodesign is one heterogeneous and multifaceted discipline that goes beyond the principle of imitation to approach collaboration with Nature, an ideal model of sustainable processes and materials. The Human-Nature relationship aims to return to a symbiotic state in which the protagonists of the binomial are no longer opposed but participate in fruitful cooperation. In this scenario, the new frontier of materials science aims to achieve products and materials starting from very particular raw materials beyond the natural ones we are familiar with, such as natural textile fibers, leather, or wood. In recent years the examples of materials developed thanks to the collaboration with microorganisms such as bacteria, fungi, and algae are increasingly concrete. Their peculiar growth and synthesis processes allow finding alternatives radically more sustainable than traditional production processes. This type of materials can represent a fundamental part of the fourth industrial revolution, thanks to the development of new cultivated, sustainable, and living materials that open unexplored frontiers of interaction. The proposed research objective is an in-depth



	<p>investigation of these materials across the various sector's applications to draw up state of art, identify its limits and potential, and investigate the possibility of proposing new ones. The project aims to integrate two different approaches towards bio-manufactured materials: a design-driven approach, where the materials are developed thanks to experimentation that starts from the design, and one more traditionally linked to the science of materials, and in particular to the study of their property-structure relationships.</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The proposed project starts from the observation that, in addition to much of the terminology, Product Design and Bioengineering also share different biomaterials-related topics and some of the materials proposed have also been studied as materials for the biomedical applications. An example is the hydrogels extracted from algae, one of the most widely materials used for the encapsulation of viable cells. On the other hand, knowledge acquired in the engineering sector regarding characterization methods, property control and transformation technologies represents a considerable asset for developing sustainable and biological materials for design, essential for the ecological transition of production systems in the new industry. Thanks to the interdisciplinary team, it is expected that the research will use the traditional tools of desk research, the study of frameworks for understanding the phenomenon, as well as laboratory activities to support the development of materials.</p>
<p><b>Educational objectives</b></p>	<p>The research's innovative and characterizing aspect is represented by the union of the skills of two disciplinary fields. In the field of design, many research activities are now based on the DIY-Materials approach (materials developed by designers) and the Material Driven Design approach, which provides guidelines for developing new materials, up to a possible specific application suitable for the material itself. Meanwhile, in the CMIC department, several projects are dedicated to studying properties and transforming nature-derived materials. Combining these two currently independent activities can represent a new concept of materials of biological origin with reduced</p>



	<p>impact. We aim at developing materials capable of integrating, as in a metabolic process, with the environment and giving valid alternatives for tomorrow's industry, as is already happening in some, still sparse, realities.</p>
<p><b>Job opportunities</b></p>	<p>Thanks to this Ph.D. program, the student explores the world of existing biomaterials, develop new ones and study innovative possibilities of interaction with them. As the Biodesign field is an increasingly growing sector, it is reasonable to expect that professionals capable of such a multifaceted approach will be highly demanded. After this Ph.D., the candidate will be able to enter the world of Industry 4.0 as a biomaterial designer or as a consultant for companies looking for sustainable alternatives to their current materials. The doctoral candidate will also have the opportunity to continue his/her academic journey as new sustainability-themed courses, are emerging every day. As an example, the master's degree in Biodesign founded in 2019 at UAL in London. She/he would also have the skills to promote the foundation and management of new laboratories dedicated to Biodesign.</p>
<p><b>Composition of the research group</b></p>	<p>0 Full Professors 2 Associated Professors 0 Assistant Professors 1 PhD Students</p>
<p><b>Name of the research directors</b></p>	<p>Valentina Rognoli</p>

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

Scholarship Increase for a period abroad	
Amount monthly	597.50 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p>Educational activities (purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences):                      financial aid per PhD student                      max 4.872,90 euros per student</p> <p>Teaching assistanship: availability of funding in recognition of supporting teaching activities by the PhD student there are various forms of financial aid both for research and teaching activities. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.</p> <p>Computer availability: 1st year, 2nd year and 3rd year: Each research group will supply PhD student with a computer, if necessary.</p> <p>Desk availability: 1st year, 2nd year and 3rd year: Each research group will supply phd student with a desk.</p>