POLITECNICO DI MILANO

PhD in BIOINGEGNERIA / BIOENGINEERING - 41st cycle

THEMATIC Research Field: DEVELOPMENT OF AN AIRWAY ON A CHIP FOR MODELING CHRONIC LUNG DISEASE

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	Organ-on-Chip (OoC) technology combines the use of microfluidics, biomaterials, and advanced cell cultures to generate and monitor miniaturized replicas of human tissues and organs in vitro. It is an enabling technology involving interdisciplinary expertise from the fields of engineering, physics, and cell/molecular biology. Application areas include environmental assessment, toxicological evaluation of chemical agents, drug screening and disease modeling, among others. The aim of the project is to develop a 3D lung-on-chip platform able to mimic the human bronchial and alveolar functions. Specifically, the platform will recapitulate the microarchitecture of the upper and distal airway and will host the main components of the immune system of the lung (alveolar macrophages, neutrophils). Therefore, the platform will recapitulate the events underlying chronic epithelial responses and inflammation of respiratory diseases such as asthma, chronic obstructive pulmonary disease (COPD) and bronchiectasis (BE).
Methods and techniques that will be developed and used to carry out the research	The design and the development of new advanced microscale in vitro platforms will consider state-of-the-art technologies, micro- and nano-fabrication. Computational modeling will be used to optimize geometrical parameters. The design and the development of new advanced microscale in vitro platforms will consider state-of-the-art

	microscale in vitro platforms will consider state-of-the-art technologies, micro- and nano-fabrication. Computational modeling will be used to optimize geometrical parameters. The proposed research plan is divided into 3 Actions. A1: Development of lung epithelial barrier on chip using cells derived from patient with COPD or BE or asthma. A2: Integration of immune components in the lung model. A3: Definition of a protocol for the exposure of inflammatory cytokine (e.s IL13) or growth factor (e.s EGFs ligands) or environmental toxic agent (cigarette smoke extract) for mimicking chronic bronchial responses and inflammation of the lung and evaluation of immune system response. The research will be implemented at the MiMic Lab, Department of Electronics, Information and Bioengineering of Politecnico di Milano, while secondment periods are envisioned.
Educational objectives	To train the PhD student in organs-on-chip technology, microfluidics, microfabrication, soft-lithography, cell culture applications, micro-bioreactors. http://www.biomech.polimi.it/mimiclabhttps://www.polifab.polimi.it/
Job opportunities	The research will be carried out in strong cooperation with Chiesi Farmaceutici S.p.A., a pharmaceutical company leader in the development of drugs and therapies for respiratory-related diseases.
Composition of the research group	1 Full Professors 1 Associated Professors 4 Assistant Professors 10 PhD Students
Name of the research directors	Prof. Marco Rasponi

Contacts
Prof. Marco Rasponi marco.rasponi@polimi.it, +39-02-2399-3377

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents	--

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

1. **Educational activity:** The student will be encouraged to attend to courses with subjects in tissue engineering, cell and tissue culture, micro and nanofabrication either at POLIMI or abroad in International Schools.
2. **Teaching assistantship:** There are various forms of financial aid 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 regulations.
3. **Computer and desk availability:** the student will be allowed to access facilities of both CBLab and µBSLab of the DEIB.