POLITECNICO DI MILANO

PhD in BIOINGEGNERIA / BIOENGINEERING - 39th cycle

PNRR 118 INTERDISC Research Field: QUANTIFICATION OF INFLAMMATION BY POSITRON ANNIHILATION SPECTROSCOPY (INFLAMMATRON)

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	The permeability of blood capillaries increases significantly in the progression of inflammation, to allow for extra-vasation from the blood of immune cells and signals that populate the inflamed tissue. Also, the permeability of capillaries increases in solid tumors, allowing the intra-vasation of cancer cells that detach from the primary tumor. The permeability of the capillary wall depends primarily on the molecular organization of the junctions that form between adjacent vascular cells. The specific goal of this project is to measure a quantitative index of permeability of the capillary wall by means of a label-free spectroscopic technique called Positron Annihilation Spectroscopy (PAS). The PAS technique can in fact correlate the annihilation lifetime of positrons irradiated in a material, with the materials' molecular organization. In case of success of the project, we will obtain a microvascular permeability index based on PAS. This revolutionary concept holds the potential to be transferred to the clinics, to diagnose conditions involving inflammatory processes, microvascular disease, and tumor progression. Within this context, the present proposal covers the main Health domains.
Methods and techniques that will be developed and used to carry out the research	The proposed PhD project is based on an interdisciplinary approach combining bioengineering and particle physics. The experience and specialization of the proponent research groups will be combined as follows. Prof. C. Conci is expert in non-invasive high-resolution microscopy

	Conci is expert in non-invasive high-resolution microscopy techniques applied to measure engineering parameters in microvascular vessels, especially in living animals (in vivo). He works in the mechanobiology group, led by Prof. M.T. Raimondi, having been awarded by 5 ERC grants in the field consolidated frontier tools for biological research. The group of Prof. R. Ferragut has an extensive strong track record in the study of the chemical environment of the positron annihilation sites, both in organic and inorganic materials (polymers, hybrid materials, etc.).
Educational objectives	The general motivation of this proposal is to create a new figure of “physical bioengineer”, with solid bases in intravital imaging and in positron annihilation spectroscopy, able to develop frontier methodologies for non-invasive diagnosis of microvascular permeability as a diagnostic sign in inflammation. The candidate will be part of two international teams of Politecnico di Milano (the Mechanobiology group, located at the campus Leonardo, see http://www.nichoid.polimi.it/mechanobiologylab/ and the VEPAS group, located at the campus Como see http://www.como.polimi.it/positron). The candidate will carry out the research with exchange periods between partners. The candidate will take part in research meetings, working in an EU context. Besides acquiring specific expertise on the methodologies used, and publishing the obtained results, the candidate will also improve her/his skills in team collaboration, deadline compliance and research reporting.
Job opportunities	The acquired expertise will open different job opportunities as a researcher and/or research specialist in public research institutions, hospitals (e.g. IRCCS), medical centers and in manufacturers of instrumentation for positron emission tomography. Companies and institutions interested in applications of label-free medical imaging and diagnostics (as Siemens, Hamamatsu, Philips, etc.) will take a dramatic advantage from the collaboration with a PhD with this kind of experience.
Composition of the research group	1 Full Professors 2 Associated Professors

	2 Assistant Professors 0 PhD Students
Name of the research directors	PROF CLAUDIO CONCI

Contacts
claudio.conci@polimi.it, 0223994729

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

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	
By number of months at the company	0
Institution or company where the candidate will spend the period abroad (name and brief description)	European Organization for Nuclear Research (CERN)
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
The PhD student will be involved in educational activities along with teaching assistantship. A shared desk and computer will be given to the student for the time needed to carry out the research.