



PhD in BIOINGEGNERIA / BIOENGINEERING - 39th cycle

THEMATIC Research Field: STUDY OF THE IMPACT OF BIOMECHANICS ON THE DEVELOPMENT AND PROGRESSION OF AORTOPATHIES

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	<p>Aortopathies are a group of disorders characterized by aneurysms and dilation of the aorta that ultimately can lead to its catastrophic rupture without ominous symptoms. Their prevalence is increasing; hence they represent a relevant clinical problem.</p> <p>Aortopathies can have different aetiologies, spanning from the undesired effect of aortic surgery to genetic disorders such as Marfan Syndrome. In any case, evidence suggests that biomechanical factors, such as aortic wall stiffness and blood fluid dynamics, play a crucial role in the development of the pathology and to its progression towards the aforementioned endpoints.</p> <p>The research activity herein proposed aims to developing methods to quantify aortic biomechanics, with an emphasis on fluid dynamics, based on clinical imaging and through computational modelling.</p> <p>The successful candidate will:</p> <ul style="list-style-type: none"> - develop and implement algorithms for the automated reconstruction of the 3D geometry of the thoracic aorta from different imaging modalities, including computed tomography (CT) and magnetic resonance imaging (MRI); - refine and expand previously developed tools for the morpho-functional quantitative assessment of the aorta; - develop and implement two classes of methods to quantify aortic fluid dynamics, including wall shear stresses, and to estimate aortic wall stiffness: <ol style="list-style-type: none"> 1. through the processing of 4DFlow MRI data 2. by means of numerical simulations performed on



	<p>image-based and patient-specific geometrical models of the aorta and accounting for patient specific boundary conditions;</p> <ul style="list-style-type: none"> - apply the developed methods to the analysis of cohorts of patients, including a population of Marfan patients; - identify potentially meaningful indices to grade the severity of fluid-dynamic derangements and test their correlation with the presence of markers circulating in peripheral blood and with the progression of the aortopathy as assessed through imaging at follow-up. <p>The activity will be carried out both at Politecnico di Milano and at IRCCS Policlinico San Donato, which funded the scholarship.</p>
Methods and techniques that will be developed and used to carry out the research	<p>Understanding of radiologic imaging Advanced coding skills for software development Implementation of methods for advanced off-line processing of medical imaging Numerical modeling</p>
Educational objectives	<p>Understanding of radiologic imaging Advanced coding skills for software development Implementation of methods for advanced off-line processing of medical imaging Numerical modeling</p>
Job opportunities	<p>Academic researcher Clinical researcher Industrial R&D in radiologic imaging/image processing</p>
Composition of the research group	<p>1 Full Professors 2 Associated Professors 4 Assistant Professors 0 PhD Students</p>
Name of the research directors	<p>Proff Emiliano Votta - Fabio Martelli</p>

Contacts
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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

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

A shared desk and computer will be given to the student for the time needed to carry out research. Short periods of teaching assistantship are foreseen during the program. Frequent direct interaction with clinicians, as well as working activities to be carried out at Policlinico San Donato, are envisioned.