



# PhD in BIOINGEGNERIA / BIOENGINEERING - 40th cycle

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

<b>Monthly net income of PhDscholarship (max 36 months)</b>
<b>€ 1400.0</b>
In case of a change of the welfare rates during the three-year period, the amount could be modified.

<b>Context of the research activity</b>	
<b>Motivation and objectives of the research in this field</b>	<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.</p> <p>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>
<b>Methods and techniques that will be developed and used to carry out the research</b>	<p>The successful candidate will:</p> <ul style="list-style-type: none"> <li>- 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);</li> <li>- refine and expand previously developed tools for the morpho-functional quantitative assessment of the aorta;</li> <li>- develop and implement two classes of methods to quantify aortic fluid dynamics, including wall shear</li> </ul>



	<p>quantify aortic fluid dynamics, including wall shear stresses, and to estimate aortic wall stiffness:</p> <ol style="list-style-type: none"> <li>1. through the processing of 4DFlow MRI data</li> <li>2. by means of numerical simulations performed on image-based and patient-specific geometrical models of the aorta and accounting for patient specific boundary conditions;</li> </ol> <p>- 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> <p>The activity will be carried out both at Politecnico di Milano and at IRCCS Policlinico San Donato, which funded the scholarship.</p>
<b>Educational objectives</b>	<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>
<b>Job opportunities</b>	<p>Academic researcher                  Clinical researcher                  Industrial R&amp;D in radiologic imaging/image processing</p>
<b>Composition of the research group</b>	<p>1 Full Professors                  1 Associated Professors                  4 Assistant Professors                  0 PhD Students</p>
<b>Name of the research directors</b>	<p>Emiliano Votta - Fabio Martelli</p>

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