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Master's Internship leading to a PhD

COMPUTATIONAL STUDY OF THE REDUCTION OF THE THROMBOGENICITY OF ARTIFICIAL SURFACES

CONTEXT

When blood flows over an artificial material, circulating platelets are activated and recruited, leading to the formation of a thrombus (blood clot). The thrombogenicity of biomedical systems (artificial valves, ventricular assist devices, extracorporeal circulation, artificial heart, etc.) is a major obstacle to their use in the treatment of cardiovascular diseases. An original methodology to increase the haemocompatibility of these systems consists in reducing platelet adhesion through the use of micro-structured surfaces that allow control of the near-wall flow. IMAG uses numerical simulations to shed light on the mechanisms by which surface topography can modify the dynamics of blood platelets and reduce their natural tendency to adhere to artificial surfaces. This analysis, complemented by experimental studies carried out by biophysicists at the University of Montpellier and bioengineers at the University Hospital of Aachen in Germany, aims to provide the scientific foundation for future innovations in the design of biomedical systems with increased haemocompatibility.

INTERNSHIP'S OBJECTIVES

This internship offers high-level training in cardiovascular science and technology. The student will be immersed in a dynamic research team and will develop the scientific and technical skills needed to pursue a doctoral project on this topic. Candidates who demonstrate strong scientific potential and good integration into the team will be supported in applying for upcoming PhD grants, such as EU-funded MSCA Doctoral Networks, with a view to starting a PhD the following autumn. The selected student will join the team of developers/users of the YALES2BIO software developed at IMAG and dedicated to the simulation of blood flows. He or she will be in charge of the following tasks:

1- Learn how to use the YALES2BIO and associated pre- and post-processing tools,
2- Perform small-scale simulations to support the analysis of the roughness-induced lifting mechanism recently unravelled at IMAG,
3- Determine the size and shape of the roughness that maximises the lifting effect and has the greatest potential in terms of haemocompatibility

These tasks will also be part of the PhD program, which will additionally include the modelling of the von Willebrand factor (a key blood component in the platelet adhesion process) and the development of a macroscopic model capable of representing platelet-surface interactions in such simulations. During the PhD, the student will also collaborate with experimentalists and with a blood pump manufacturer, which will use the macroscopic model thus developed; he/she will of course take part in the regular meetings with the team's many collaborators.

DESIRED PROFILE

Master's degree or engineering background with a focus on fluid mechanics and/or biomechanics and/or numerical methods. A strong interest in pursuing a PhD is mandatory.

INTERNSHIP LOCATION AND ALLOWANCE

IMAG laboratory of the University of Montpellier // approximately 600 €/month.

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