About me – Maria Boumpouli, University of Strathclyde – Mac Robertson Postgraduate Travel Scholarship

Figure 1: Enjoying the good weather in Spain.

My name is Maria Boumpouli and I am a third year PhD student at the Biomedical Engineering Department, University of Strathclyde. My research, supervised by Dr Asimina Kazakidi and Prof Terence Gourlay, focuses on blood flow dynamics in adult patients with congenital heart diseases (CHD). These patients are operated early after birth but are at risk of chronic complications in adulthood and further surgical interventions are needed. However, clinicians have difficulties in identifying the right timing to perform the surgery. In this project, we use computational tools in order to study the haemodynamic environment in the pulmonary arteries of the adult population of patients with CHD. Our aim is to identify key parameters that affect the blood flow and could potentially help clinicians with their decision of when to intervene. One of the limitations in such computational studies, though, is the simplifications and the assumptions of the computational models, mostly concerning the boundary conditions. Although information about the fluid flow and parameters that affect it can still be obtained from previous studies, there is still a gap still in the understanding of blood flow effects in the pulmonary bifurcation.

Why I applied for the travel scholarship

I applied to the Mac Robertson Travel Scholarship at the academic year 2019-2020, in order to spend two and a half months at the Barcelona Supercomputing Centre (BSC), Spain. The collaborating research team in this institute have developed a complex computational code, named Alya Red, which could help me overcome some of the limitations and simplifications of the simulations I performed prior to my visit. In BSC, there are people with expertise in a wide range of fields and combining their knowledge was the perfect opportunity for me to perplex my simulations and consider more realistic boundary conditions. We therefore decided to contact Dr Jazmin Aguado Sierra, a researcher at the computational mechanics group of BSC where the focus of their research is on the mechanics of the

heart. After a very interesting first Skype call with her, receiving the funding was the only thing we were waiting to organise my visit!

Details of the visit

On October 6th, 2019 I landed in Barcelona, the capital and biggest city of the community of Catalonia. The warm weather was the first great welcome I received, only to be followed by many more, from the people I met.

It was the next day, Monday 7th of October, that my journey to BSC started. BSC is located at the UPC campus, at a quiet area outside of the city centre, surrounded by parks. Right from the very start I had a full and very interesting day, with Jazmin showing me the place and introducing me to the rest of the group. A visit at the supercomputer located inside a church in the campus was the highlight of the tour of that day! We also attended the PhD defence of one of Jazmin's students. It was a very interesting and educating experience, which gave me an idea of what to expect when I have to defend my own PhD!

Figure 2: Visit at MareNostrum Supercomputer at BSC located within the old church

During the first week I mainly focused on understanding the code, and how to implement each new boundary condition to my simulations. Many people helped me in that: Costa was the one to introduce me to Alya and explained to me how to run the simplest fluid mechanics simulations. Eva was the expert of the group in the solid mechanics, a field completely new to me but relevant to blood flow simulations if you want to consider the elasticity of the arteries. Alfonso helped me understand the theory behind fluid-structure interaction (FSI), the combination of fluid and solid mechanics. At this point, a group meeting was arranged at which I presented my PhD findings to date, discussed the objectives of my visit, and with everyone's help, set our goals for the remaining of my visit.

The rest of the days were spent working in introducing all the new concepts in my simulations by combining the work of different people from the group. It was very challenging but fascinating to do,

and everyone was keen to help with any questions or difficulties I came across. My supervisor Melina, and Jazmin were always there to advice and guide me. My visit to BSC ended on December 13th, 2019, with a presentation of the things achieved so far, and the work to be continued from Glasgow.

Figure 3: Goodbye drinks on last day of work in BSC

Impact of scholarship

The Mac Robertson Travel Scholarship gave me the opportunity for a great life experience. I collaborated and met people from different fields, expanded my knowledge in a satisfactory level, and used resources that I wouldn't otherwise have access to.

On a personal level, I am extremely lucky to be given this opportunity and upgrade my skills and PhD work in such an extent. Besides work though, I met very interesting people, made new friends and had a lot of fun. I definitely enjoyed Barcelona's weather, food and culture! It is a trip that I will never forget, and I gratefully thank Mac Robertson Trust for this opportunity.

Figure 4: Left: Girona, Spain; Right: Park Güell, Barcelona

Figure 5: Dali's museum in Figueres, Spain

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