Job Title: PhD Student

Research area or group: Biomaterials, Biomechanics and Tissue Engineering Group

Description of Group/Project:

The BBT Group is looking for a predoctoral student to develop his/her PhD thesis project on the development of new biodegradable stent to solve pediatric aortic coarctation. The project will be within the framework of one of the research lines of the BBT, whose objective is the fabrication of biodegradable metallic and polymeric stents by additive manufacturing.

The term "aortic coarctation" describes an abnormal narrowing of the main artery in our body, the aorta. Each 4 of 10,000 people are born with this serious complication. It accounts for 4-6% of all congenital heart defects and is more common in male than in females (59% versus 41%). Clinicians today treat patients with aortic coarctation using two main approaches. One approach involves open heart surgery to surgically remove the aortic segment with the severe narrowing. The other, less invasive approach is balloon angioplasty and implantation of an endovascular stent which re-opens the vessel lumen accessing it from within using a catheter. The most recurrent side effect of surgery is that most patients, despite improvements in technique and materials, require frequent reinterventions. **The main objective of our proposed research is to design and develop new polymeric stents adaptable to the artery growing needs of children affected with coarctation that effectively minimize and/or eradicate new interventions**.

The working hypothesis of this project is that stent designs coupled with materials able to gradually change their properties with time (i.e. expand and degrade) will be able to match arterial changes provoked by natural growth and tissue remodeling in the treatment of pediatric aortic coarctation. More specifically, we hypothesize that auxetic designs and shape-memory polymeric materials will outperform metal stents and hold the arterial lumen open for longer time due to better device integration with the growing blood vessel.

In particular, the candidate will be in charge of is the development of a stent with shape memory properties able to adapt its shape to the aorta patient's needs. Moreover, surface modifications strategies will be developed and applied to fabricated stents to promote faster re-endothelialization.

Main tasks and responsibilities

- Fabrication of a novel biodegradable shape memory polymer (SMP) stent by additive manufacturing onto a rotating mandrel.
- Create surface micropatterns on the manufactured stents, biomolecule's synthesis and stent functionalization that will favor the formation of a healthy and functional endothelium.
- Surface modified SMPs stents will be carefully characterized by means of a wide range of mechanical and physicochemical methods, *in vitro* biological dynamic studies with a bioreactor, and thrombogenicity tests. The *in vivo* biological response of the most

promising stents will be performed in an animal model of aortic coarctation in New Zealand Rabbits.
- Elaboration of periodic reports to keep track of the project progress.
- Preparation of scientific manuscripts and presentations in workshops or conferences to showcase your research results to the scientific community.

This PhD student will be in charge of the experimental part of POLYCOARCT subproject (PID2021-124868OB-C22) granted in the Proyectos de Generación de Conocimiento 2021 call.

Requirements for candidates:

- Education: In possession of, or about to finish, a Master degree in materials science/engineering, biomedical science/engineering, biology, chemistry, physics or closely related field.
- Competencies and skills: Communication, Teamwork and collaboration, Commitment, Proactivity, Integrity, Critical and Analytical thinking.
- Demonstrated labwork experience and experimental skills, self-discipline to achieve reproducible results. Ability to work safely in the lab environment.
- Expertise in cell cultures, confocal fluorescence microscopy and cellular and molecular biology techniques will be valued, but not essential.
- Language: English (Advanced, written and spoken), knowledge of Spanish or Catalan would be beneficial.
- Supervision of Master students.

Summary of conditions:

Financial support will be obtained upon successful application to various institutional fellowships within the project POLYCOARCT subproject (PID2021-124868OB-C22) granted in the Proyectos de Generación de Conocimiento 2021 call. Thus, a minimum overall grade score of 6,5 is required. Starting date is last quarter 2022, first 2023. The PhD studies will be taken at Campus Diagonal-Besòs from Universitat Politècnica de Catalunya (UPC) in Barcelona and the *in vivo* studies will be carried out in collaboration with Hospital de Nens Sant Joan de Déu (HSJD), Institut Químic de Sarrià (IQS) and Massachussetts Institute of Technology (MIT), offering a dynamic ecosystem with enthusiastic colleagues. The candidate will be specifically trained on materials fabrication, characterization, biomolecules synthesis and in vitro and in vivo biological studies and analysis. In addition to acquiring broad scientific multidisciplinary knowledge, the candidate will access the soft skill courses offered at BBT. Participation to national/international conferences and international research stays will be also encouraged. He/she will gain communication and technology transfer skills and will be trained from the beginning to get familiar and follow the Good Laboratory Practice and Responsible Research and Innovation principles.

How to apply:

If you are interested, please submit your application containing a cover letter, a full CV including your contact details and 2 reference letters or referee contacts to **marta.pegueroles@upc.edu**