

MeDiTATe project

Newsletter N°2 – May 2023

The MeDiTATe project aims to deliver new technologies targeted at industrial and clinical translation to accelerate the process of personalized cardiovascular medical procedures, validated through an integrated experimental programme to improve patient care.

This issue of the newsletter focuses on the main advancements of the MeDiTATe project achieved during the first months of the 2023 where relevant research contributions with respect to the state of the art have been finalised by our 14 Early Stage Researchers in all the topics of the MeDiTATe project: 3D printing, advanced computational modelling, experimental activities and artificial intelligence. Several papers are already published, other are incoming in the second quarter of 2023. Some of our ESRs are concluding their PhD period and they are finalising their PhD Thesis. Please enjoy reading about the latest activities of our ESRs!

Scientific publications

“Potential of auxetic designs in endovascular aortic repair: A computational study of their mechanical performance”

Rahul Sathish Vellaparambil, ESR 08 of the MeDiTATe project, published the paper titled *Potential of auxetic designs in endovascular aortic repair: A computational study of their mechanical performance* in the **Journal of the Mechanical Behavior of Biomedical Materials**.

The work was developed in collaboration with Woo-Suck Han and Stéphane Avril from **Mines Saint-Étienne** and Pierluigi Di Giovanni from the R&D department of **HSL**.

The paper, whose abstract is reported in the following lines, is available at this [link](#).



Potential of auxetic designs in endovascular aortic repair:
A computational study of their mechanical performance



Rahul Sathish Vellaparambil
ESR 08

“Fabrication of Compliant and Transparent Hollow Cerebral Vascular Phantoms for In Vitro Studies Using 3D Printing and Spin-Dip Coating”

Beatrice Bisighini, ESR 03 of the MeDiTATe project, published the paper *Fabrication of Compliant and Transparent Hollow Cerebral Vascular Phantoms for In Vitro Studies Using 3D Printing and Spin-Dip Coating* in the **Materials journal** by MDPI.

The paper, developed in collaboration with Pierluigi Di Giovanni (**HSL**), Alba Scerrati (**University of Ferrara**), Federica Trovalusci and Silvia Vesco (**University of Rome “Tor Vergata”**), is available on the MDPI website at this [link](#).



Fabrication of Compliant and Transparent Hollow Cerebral
Vascular Phantoms for In Vitro Studies Using 3D Printing and
Spin-Dip Coating



Beatrice Bisighini
ESR 03



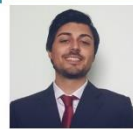
This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 859836.

“Assessment of shape-based features ability to predict the ascending aortic aneurysm growth”

Leonardo Geronzi, ESR 02 of the MeDiTATe project, published the paper *Assessment of shape-based features ability to predict the ascending aortic aneurysm growth* in the **Frontiers in Physiology** journal. This work involved the collaboration of several universities, research centres and three French hospitals. [Antonio Martinez Pascual, ESR 01](#) of the MeDiTATe project, also participated in this work. The full paper is available at this [link](#) on the Frontiers journal website.



High fidelity fluid-structure interaction by radial basis functions mesh adaption of moving walls: a workflow applied to an aortic valve



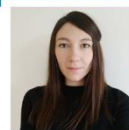
Leonardo Geronzi
ESR 02

“Uncertainty Quantification in the In Vivo Image-Based Estimation of Local Elastic Properties of Vascular Walls”

A new paper *Uncertainty Quantification in the In Vivo Image-Based Estimation of Local Elastic Properties of Vascular Walls* has been published in the **MDPI Journal of Cardiovascular Development and Disease** in collaboration with the MeDiTATe project. The paper was written by Benigno Marco Fanni (BioCardioLab [FTGM](#)), [Maria Nicole Antonuccio, ESR 14 of the MeDiTATe project](#), [Simona Celi](#) (BioCardioLab FTGM), Alessandra Pizzuto and Giuseppe Santoro (Pediatric Cardiology Unit, FTGM), Sergio Berti (Adult Cardiology Unit, FTGM). The full paper is available at this [link](#).



Uncertainty Quantification in the In Vivo Image-Based Estimation of Local Elastic Properties of Vascular Walls

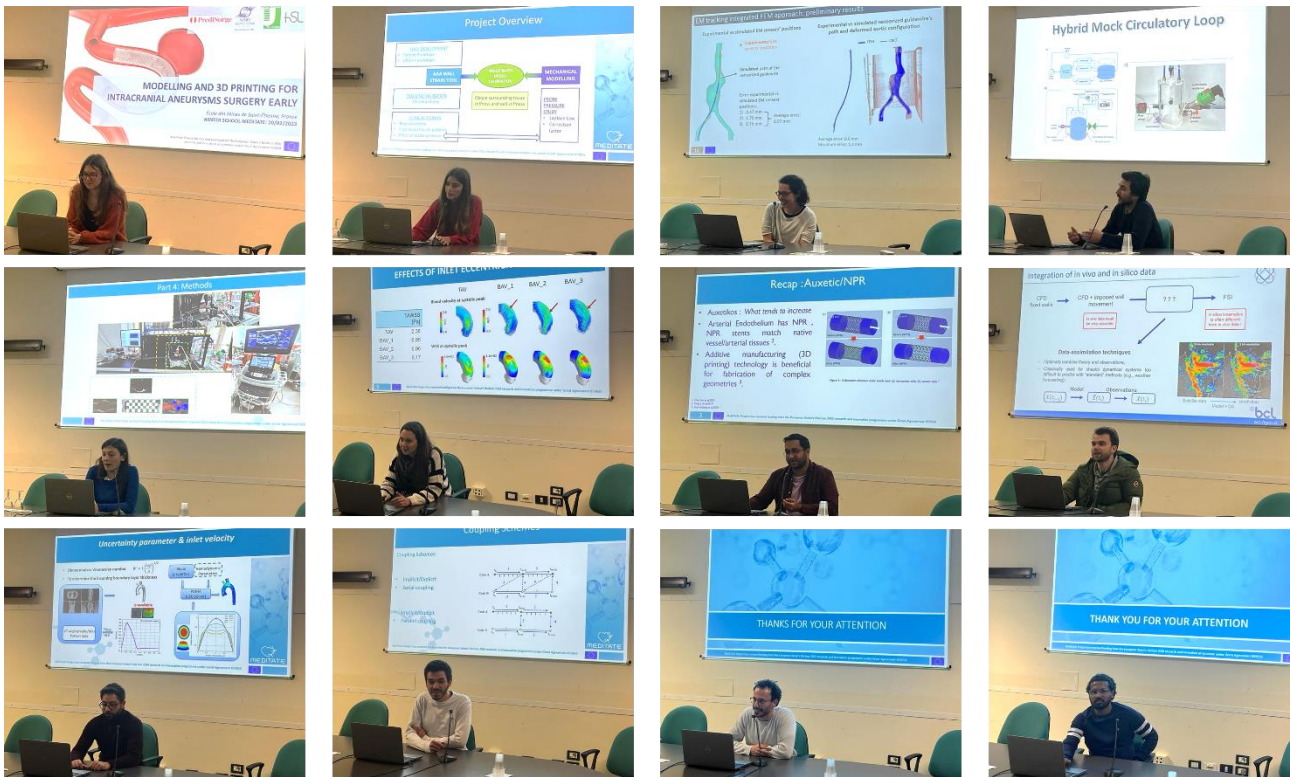


Maria Nicole Antonuccio
ESR 14



Trainings

Winter School "Big Data Analytics, from engineering to clinical"



The **Fondazione Toscana G. Monasterio** hosted the MeDiTATe project Winter School "Big Data Analytics, from engineering to clinical". The event took place from 20th to 24th February 2023 at Pisa, Italy.

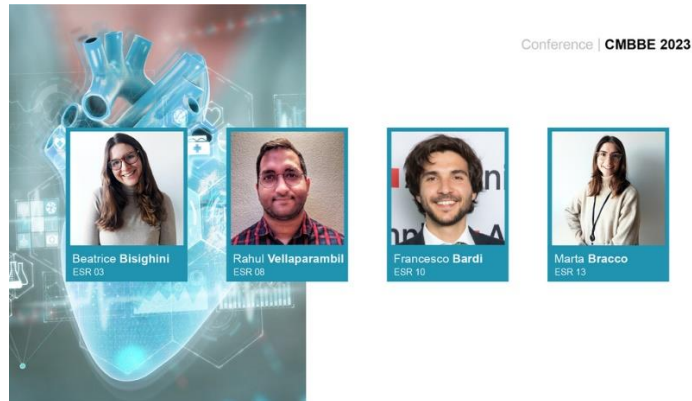
The **Early Stage Researchers** of the MeDiTATe project had the opportunity to follow several courses regarding both the clinical and genetic view of aneurysms and the application of AI and big data to hemodynamics studies.

The Winter School was also an opportunity to strengthen the collaboration among the Early-Stage Researchers and to present their own results.



Events

CMBEE23 congress



The MeDiTATe project was present at the 18th International Symposium on Computer Methods in Biomechanics and Biomedical Engineering ([CMBBE 2023](#)). The event took place on 3 – 5 May 2023 in Paris, France.

In this occasion four of our [Early-Stage Researchers](#) (ESRs) presented the results of their activities:

- **Beatrice Bisighini** – ESR 03: *Towards a real-time simulator of flow diverters deployment based on model order reduction.*
- **Rahul Sathish Vellaparambil** – ESR 08: *In silico analysis of Auxetic inspired stent-grafts for endovascular aortic repair.*
- **Francesco Bardi** – ESR10: *Preoperative hemodynamic simulation of a patient specific eva procedure.*
- **Marta Bracco**–ESR 13: *Validation of abdominal aortic aneurysm motion tracking with simulated ultrasound cine-loops.*

More details [here](#).

MASH congress



The MeDiTATe project was present at the [MASH's congress](#). The event took place on 4 – 6 May 2023 at the University of Corsica in Bastia, France. In this occasion two [Early-Stage Researchers](#) (ESRs), [ESR 01 Antonio Martinez Pascual](#) and [ESR 02 Leonardo Geronzi](#) presented the results of their activities with a joint talk whose title is "*Ascending aortic aneurysm growth prediction based on shape and fluid-dynamics biomarkers*". More details [here](#).



This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 859836.

MeDiTAlks

An interview with Dr. Simona Celi, Ethic Coordinator of the MeDiTATE project.



INTERVIEW WITH



Dr. Simona Celi

Academic Supervisor of ESR 09, ESR 10 and ESR 14

We had a small talk with Prof. Simona Celi, a member of the Board of the MeDiTATE project. She is a Senior scientist at Fondazione Toscana G. Monasterio (FTGM) and co-founder of the BioCardioLab. In her experience, she participated to several National and International research projects and currently she is the technical Project Investigator (PI) and sub-unit PI of three national research grants. During the project, she will be supervising ESR09, ESR10 and ESR14.

The MeDiTATE project, a research proposal funded by the European Commission in the framework of Horizon 2020 programme. Can you tell us about FTGM and its role in the project?

FTGM is one of the main clinical centres in Italy. It is a public highly specialized centre for the treatment of cardiovascular and pulmonary diseases for both adults and paediatrics, including rare diseases of special interest, such as congenital heart disease. FTGM is characterised by an internal bioengineering unit with a highly specialized laboratory (BioCardioLab) to support physicians with several research activities, such as advanced image processing, artificial intelligence, numerical simulation, 3D printing and experimental activities. In the context of the Meditate project, in fact, FTGM participate with 3 ESRs hosted by BioCardioLab. Research covers both numerical and experimental activities. The aim of ESR9 is to identify morphological/bio-humoral/hemodynamic variables which are of great importance in aneurysm stabilization or rupture, through Big Data Analysis techniques. The aim of ESR10 is to develop a combined experimental and computational platform to model the Endovascular Aneurysm Repair (EVAR) Procedure for ascending thoracic aortic aneurysm treatment. The aim of ESR14 is contributing to the development of a new tool for estimating non-invasively hemodynamic descriptors in the aorta, such as blood flow and pressure, through dynamic Doppler Ultrasound imaging. Finally, FTGM is lead of the ethical aspects concerning MeDiTATE project.

Could you briefly explain why the presence of a real clinical entity can be an important asset for this project?



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Well, there are several added values concerning the presence of a clinical centre. From one hand the high level of competences in the cardiovascular field from both medical and engineering point of view that is fundamental for a deep knowledge and comprehension of the aneurysmatic diseases, and from the other hand the translation aspect of the biomedical research. Our ESRs have the opportunity to be immersed in a real clinical environment and have the possibility to see the real needs of a physicians and all the activities that a bioengineer can provide to them.

What are the challenges that the candidates are facing while operating "on the field"? Which skills do you think that the fellow will acquire at the end of this journey?

All the members of the MEDITATE consortium work in closed synergy to provide a real working experience in different scenario from academia and research centres to industry. In the biomedical research we have to combine to several complex aspects that requires technical competences but also the capability to translate them towards clinics. Their experience in an hospital could heal the early-stage researchers towards this vision supporting them in their career. From a technical point of view the presence of research clinical and biomedical center is an added value since it can provide a pragmatic view for an exploitable solutions and applications.

As member of MeDiTATe's Board and Director of BioCardioLab, you play roles of great responsibility. Also considering that in the MeDiTATe project half of the ESRs are women, do you think that this project can inspire more women to pursue their career in STEM field?

In context of the Meditate project we have demonstrate that science is neutral. All the ESR have been selected for their scientific profile. We have a natural gender balance at different levels, not only for the ESRs enrolled but also for the tutors and for the key persons. This is the only way that I can image for science. In my daily activities, I try to promote STEM without any kind of bias, and if this can inspire more women to pursue careers in STEM, I have achieved a new goal.

Any message for our readers.

Follow your dreams, work with passion, and do everything you can to achieve them. Do not stop learning.

